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HX200S

Hand-Phone II
5 Watt VHF/FM
Marine Radio

Contains:

- ☐ Specifications
- ☐ FCC Information
- ☐ Operation
- ☐ Installation
- ☐ Theory of Operation
- ☐ Performance Tests
- ☐ Alignment Procedure
- ☐ Troubleshooting Charts
- ☐ Complete Drawings
- ☐ Parts Lists

Service Manual



HORIZON HANDPHONE II
HX200S
5-WATT VHF/FM
Marine Handheld Transceiver

This manual is intended for use by qualified technicians and includes all necessary information pertaining to HX200SII operation, programming, and maintenance. Changes which occur after the printed date will be incorporated in supplemental service publications.

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TEXT

1. Specifications	3
2. General Information	5
3. Programming	7
4. Operation	9
5. Theory of Operation	13
6. Maintenance	17
7. Drawings	27
8. Parts List	37

FIGURES

Figure 1. Control Locations	9
Figure 2. Functional Block Diagram	14
Figure 3. PLL/TX Setup	18
Figure 4. Alignment Reference Points	19
Figure 5. RX Test Setup	20
Figure 6. PLL Troubleshooting Chart	22
Figure 7. RX Troubleshooting Chart	23
Figure 8. TX Troubleshooting Chart	25
Figure 9. Schematic Diagram	29
Figure 10. P.C. Board Layout	31
Figure 11. Semiconductor Pin Details	33
Figure 12. Chassis Assembly	34
Figure 13. Exploded Parts View	35

I HX200SII SPECIFICATIONS

Performance specifications are nominal, unless otherwise indicated, and are subject to change without notice.

1.1 GENERAL

Frequency Range	TX 156.025 to 157.425 MHz*	
	RX 156.050 to 163.275 MHz*	
Number of Channel	55 Regular 6 Weather 47 Additional, Available for future expansion	
Input Voltage	10 VDC (+15%)	
Current Drain (Standby)	35 mA max.	
	(Receive)..... 300 mA max.	
	(Transmit) 1.3 A High; 0.7 A Low	
Channel Spacing	25 kHz	
Battery Life		
CNB6		
5% TX, 5% RX, 90% Standby	5 hrs. 30 min. Low 3 hrs. 50 min. High	
10% TX, 10% RX, 80% Standby ..	3 hrs. 20 min. Low 2 hrs. 15 min. High	
CNB7		
5% TX, 5% RX, 90% Standby	8 hrs. 35 min. Low 6 hrs. 15 min. High	
10% TX, 10% RX, 80% Standby ..	5 hrs. 30 min. Low 3 hrs. 50 min. High	
Dimensions	7-H-by-2 3/4-W-by- 1 1/2-D in.	
Weight	1 1/2 lb	
Compliance	FCC Parts 81 and 83	
FCC Type Acceptance		
Number	APV9T21085	
DOC Type Approval Number ...	Pending	
GSA Contract Number	Pending	

1.2 RECEIVER

(Measurements made in accordance with EIA Standard RS-316-B.)

Sensitivity	
12 dB SINAD	0.32 μ V
20 dB Quieting	0.35 μ V
Squelch Sensitivity	

(Threshold)	0.25 μ V max.
Modulation Acceptance	
Bandwidth	+7.5 kHz min.
Selectivity	60 dB min.
Spurious and Image	
Rejection	40 dB min.
Intermodulation Rejection ..	55 dB
Audio Output at	
10% Distortion	0.8 W min.
Freq. Stability	
-30° to +60° C	+0.0005% max.
Channel Spread	2.5 MHz max.

1.3 TRANSMITTER

(Measurements made in accordance with EIA Standard RS-316-B.)

RF Power Output	5 W High; 1 W Low
Spurious and Harmonic	
Emissions	55 dB High; 50 dB Low
FM Hum and Noise	30 dB min.
Modulation	16K0G3E
Audio Distortion	10% max.
Freq. Stability	
-30° to +60° C	+0.0005% max.
Channel Spread	2.5 MHz max.

* The HX200SII is capable of being programmed anywhere within this expanded frequency range but is designed to meet its specifications only within the normal marine band frequency range, which is, TX 156.050 to 157.425 MHz and RX 156.050 to 162.025.

2 GENERAL INFORMATION

The Standard Communications Corp. (SCC) model HX200SII Horizon/ Hand-Phone is an all solid-state, VHF/FM handheld transceiver which is microprocessor-controlled and features a programmable scanning capability. It is capable of operating on 55 marine channels in the USA or International modes, six weather channels, and can be specially programmed by the user to operate on 10 additional future marine channels.

The HX200SII is designed for simplex or semiduplex use in the 156.025 to 163.275 MHz frequency range, requires 10 VDC input power for operation, and develops an RF power output of 5 watts that can be switched to 1 watt. It is powered by the supplied CNB6 nickel-cadmium battery pack or optional heavy-duty CNB7 battery pack.

The 16-button control panel provides for channel and function selection. The channel and function selection is indicated in the liquid crystal digital display which can be backlit to provide better visibility.

The HX200SII contains an: on-off/volume control, squelch control, high/low power switch, external speaker/microphone socket, antenna socket, push-to-talk switch, display light button, wall charger receptacle, channel keylock switch, built-in microphone, and battery lock. It is brown, measures 7-high-by-2 3/4-wide-by-1 1/2-deep inches, and weighs 1 1/2 pounds.

CAUTION: Do not leave the transceiver lying face up in direct sunlight for prolonged periods of time.

2.1 FCC INFORMATION

The HX200SII has been type accepted by the Federal Communications Commission (FCC) for the Maritime Radio Service, part numbers 81 and 83. The licensee must comply with all FCC rules and regulations that apply to parts 81 and 83 of the Maritime Radio Service, including the requirement that a copy of parts 81 and 83 be kept on board your ship at all times. Copies of parts 81 and 83 may be ordered from:

Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

A call sign and station license must be obtained from the FCC before the transceiver may legally be operated. The application for a station license may require the following information:

Type Accepted - Yes (FCC Parts 81 and 83)
Output Power - 5 Watts, 1 Watt
Emission - 16K0G3E
Frequency Range - 156.025 to 163.275 MHz
FCC Type Number - APV9T21085

Residents of Canada may obtain their Department of Communications (DOC) license by writing to:

Government of Canada
Department of Communication
300 Slater Street
Ottawa, Ontario
Canada, K1A0C8

The transceiver licensed to an operator may be used by unlicensed persons provided the licensed operator transmits the call sign, supervises and ends the call, and makes the necessary log entries.

2.2 POWER SOURCE

The HX200SII is equipped with the CNB6 nickel-cadmium battery pack. To remove the CNB6, depress the battery lock button while twisting the battery pack off in a counterclockwise direction. Do not use excessive force. To replace the battery pack, twist it back on in a clockwise direction.

The CNB7 is an optional heavy-duty battery pack which may be used in place of the CNB6. Refer to the Specifications section of this manual for a comparison of their duty life.

The HX200SII is supplied with the CWC20 plug-in wall charger which will charge the CNB6 battery pack in five hours, and the CNB7 battery pack in nine hours.

CAUTION: Do not charge either battery pack for periods longer than those specified or they will be irreparably damaged.

Before using your CWC20 charger in standard U.S. outlets, confirm that its power setting switch is set at 120 V. In Europe and other foreign lands, set the switch at 230 V and use the supplied wall adaptor plug.

To prevent the possibility of a short, make sure that the CWC20 is completely connected to the transceiver before it is plugged to a power outlet.

The charger terminal is located on the push-to-talk switch side of the HX200S11.

When using the optional CSA20 drop-in rapid charger, the contacts at the bottom of the CNB6 and CNB7 battery packs allow the battery packs to be charged when connected or disconnected from the transceiver. The CSA20 will rapid charge the CNB6 in 50 minutes, the CNB7 in 80 minutes. Do not over-charge.

2.3 SCOPE OF MANUAL

This manual is intended for use by licensed technicians. It contains all pertinent service information that is current as of the printing date. Changes which occur after the printing date will be explained in Service Information Inserts. The specific unabridged SCC model number covered by this manual is:

HX200SAA2S1

3 PROGRAMMING

In addition to the 55 regular marine channels and 6 weather channels, there are 101 additional semiduplex channels fixed in the memory of the HX200SII. Refer to the following table for a complete listing of them.

ADDITIONAL CHANNELS	RX FREQUENCY	TX (SIMPLEX) FREQUENCY
00	160.600*	156.000*
01	160.650	156.050
02	160.700	156.100
03	160.750	156.150
04	160.800	156.200
05	160.850	156.250
06	160.900*	156.300
07	160.950	156.350
08	161.000*	156.400
09	161.050*	156.450
10	161.100*	156.500
11	161.150*	156.550
12	161.200*	156.600
13	161.250*	156.650
14	161.300*	156.700
15	161.350*	156.750
16	161.400*	156.800
17	161.450*	156.850
18	161.500	156.900
19	161.550	156.950
20	161.600	157.000
21	161.650	157.050
22	161.700	157.100
23	161.750	157.150
24	161.800	157.200
25	161.850	157.250
26	161.900	157.300
27	161.950	157.350
28	162.000	157.400
29	162.050*	157.450*
30	162.100*	157.500*
31	162.150*	157.550*
32	162.200*	157.600*
33	162.250*	157.650*
34	162.300*	157.700*
35	162.350*	157.750*
36	162.400*	157.800*
37	162.450*	157.850*
38	162.500*	157.900*
39	162.550*	157.950*
40	162.600*	158.000*
41	162.650*	158.050*
42	162.700*	158.100*
43	162.750*	158.150*
44	162.800*	158.200*
45	162.850*	158.250*
46	162.900*	158.300*
47	162.950*	158.350*
48	163.000*	158.400*
49	163.050*	158.450*

ADDITIONAL CHANNELS	RX FREQUENCY	TX (SIMPLEX) FREQ
50	163.100*	158.500*
51	163.150*	158.550*
60	160.625	156.025
61	160.675	156.075
62	160.725	156.125
63	160.775	156.175
64	160.825	156.225
65	160.875	156.275
66	160.925	156.325
67	160.975*	156.375
68	161.025*	156.425
69	161.075*	156.475
70	161.125*	156.525
71	161.175*	156.575
72	161.225*	156.625
73	161.275*	156.675
74	161.325*	156.725
77	161.475*	156.875
78	161.525*	156.925
79	161.575	156.975
80	161.625	157.025
81	161.675	157.075
82	161.725	157.125
83	161.775	157.175
84	161.825	157.225
85	161.875	157.275
86	161.925	157.325
87	161.975	157.375
88	162.025	157.425
89	162.075*	157.475*
90	162.125*	157.525*
91	162.175*	157.575*
92	162.225*	157.625*
93	162.275*	157.675*
94	162.325*	157.725*
95	162.375*	157.775*
96	162.425*	157.825*
97	162.475*	157.875*
98	162.525*	157.925*
99	162.575*	157.975*
100	162.625*	158.025*
101	162.675*	158.075*
102	162.725*	158.125*
103	162.775*	158.175*
104	162.825*	158.225*
105	162.875*	158.275*
106	162.925*	158.325*
107	162.975*	158.375*
108	163.025*	158.425*
109	163.075*	158.475*
110	163.125*	158.525*

* Frequencies with an asterisk next to them are not presently allowed for use by the FCC.

Both receive and transmit frequencies of 46 channels out of the 101 additional channels are marked with asterisks to indicate that they are not FCC approved marine channels. The receive frequencies of another 21 channels are marked with an asterisk to indicate that they are not FCC approved, that is, only the channel's transmit frequency is approved for simplex operation, not semiduplex operation. The HX200SII is capable of being programmed to utilize these unapproved channels and receive frequencies in the event that the FCC expands the marine service to include them.

Any 10 of the 101 additional channels in the transceiver's memory may be programmed for operation by performing the following instructions.

1. Remove the four screws securing the back cover and lift it off.
2. Locate the white programming switch sheathed in a black insulating tube beneath the voltage controlled oscillator (VCO).
3. Remove the black insulating tube and set the white switch toward the side where its connective wires attach, away from the bare pin side.
4. Press the P/S (programmable/scan) button. P1 will appear on the display.
5. Select any of the additional channels from the table at the beginning of this section and enter it as a 3-digit number. For example, if channel 2 is selected, press numbered keys 0 0 2.
6. Select the simplex or semiduplex function, high or low power function, and the receive

only or receive/transmit function by pressing the numbered keys indicated in the following chart. Observe that the appropriate symbol appears in the display which confirms that the function has been selected.

KEY	FUNCTION	SYMBOL
1	Simplex	S
2	Semiduplex	D
4	High Power	H
5	Low Power	L
7	RX Only	
8	RX TX	

7. If an error is made while selecting the channel functions, press the CLR button and reprogram the unit starting with step 5.
8. To enter the channel and its functions, press the ENT button.
9. Repeat steps 4 through 8 as many as 9 times to program a total of 10 additional channels.
10. When programming is complete, slide the programming switch back to the bare pin side, away from its connective wire side.
11. Replace the insulating tube over the switch and replace it beneath the VCO.
12. Replace the back cover.

4 OPERATION

4.1 GENERAL

The controls called out in the following operating instructions are illustrated by Figure 1.

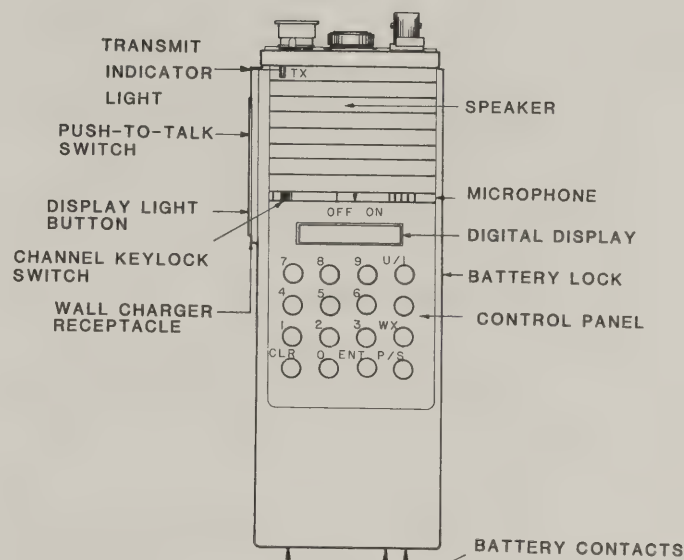
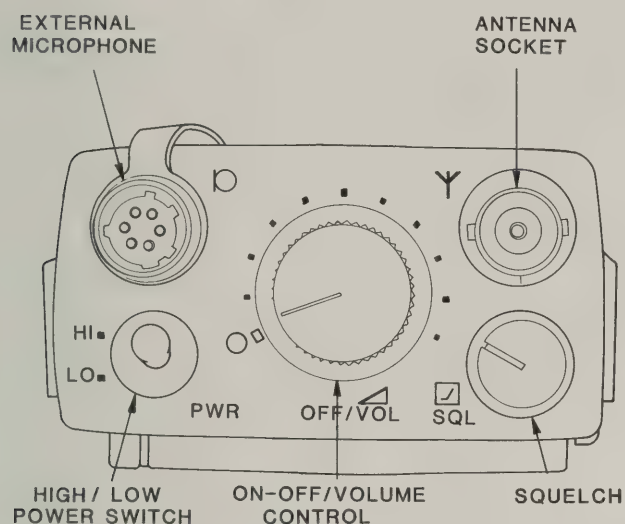


FIGURE 1. HX200SII CONTROLS LOCATIONS

1. Rotate the squelch control fully counterclockwise.
2. Rotate the on-off/volume control clockwise until obtaining the desired listening level.
3. Rotate the squelch control clockwise just until the background noise disappears.
4. Depress the 16 button and the U/I button each time you wish to change from the U.S. mode to the international mode or back again to the U.S. mode.
5. To select a channel, press one or more of the numbered keys on the control panel. (See the Marine Channel Table for available channels.) Then enter the channel by depressing the ENT button.
6. To quickly select channel 16, the distress channel, depress the 16 button.
7. To select channel one of the six weather channels, depress the WX button. Depress it a second, or third time and so forth to receive weather channel two, three, and so forth.

Weather channels frequencies are as follows:

WEATHER CHANNEL	USA RECEIVE	INTERNATIONAL RECEIVE
1	162.550	162.550
2	162.400	162.400
3	162.475	162.475
4	163.275	163.275
5	161.650	161.650
6	161.775	161.775

8. If only one channel is to be used, slide the keylock switch to the ON position.
9. If the digital display is not clearly visible, depress the display light button. The digital display indicates transceiver functions as follows:

FUNCTION	SYMBOL	LOCATION
U.S./International Mode	U or I	Upper-left
Simplex/Duplex	S or D	Lower-left
Weather Stations	WX	Lower-center-left
High/Low Power	H or L	Upper-center-right
Scan Mode	P0 - P9	Center-right

10. In compliance with FCC regulations, set the high/low power switch to the low setting when in a harbor and whenever it provides sufficient power.
11. In compliance with FCC regulations, listen to a channel to make sure it is not in use before transmitting on it.
12. To transmit, depress the push-to-talk switch (note that the transmit indicator light illuminates and hold it in while speaking into the lower-right corner of the speaker grill where the microphone is located).
13. To receive a message, release the push-to-talk switch.

4.2 PROGRAMMING CHANNEL SCAN

1. Before programming the channel scan for the first time, locate the reset switch and confirm that it is in the OFF position.

a. Remove the battery pack.

b. Pry off the round plastic cover labeled "RESET" at the bottom of the transceiver and set the reset switch to the OFF position.

NOTE: The reset switch has three functions: set it in the ON position to prevent discharge of the lithium battery during storage, switch it to the ON position for 60 seconds and then to the OFF position to erase the channel scan program or reset the microprocessor.

2. Reattach the battery pack.
3. Turn on the transceiver.
4. Press the channel 16 button and a U (U.S. mode) or I (international mode) will appear in the upper-left portion of the display window.
5. To change the channel mode (from U to I or I to U) press the U/I button.
6. Once the channel mode has been selected, press the P/S (programmable scan) button.
 - a. P1 will appear in the right portion of the display window.
 - b. Two dashes will appear in the center of the display window.

7. Program the transceiver to scan two or more channels. Choose the channels from the following chart.

- a. Press the appropriate numerical key(s), for example, key 1 for channel one, keys 1 and 6 for channel 16.
- b. Press the ENT (enter) button. Note that the channel number appears in place of the dashes.
- c. Press the P/S button. Note that the displayed P number will advance, for example, from P1 to P2.
- d. Press the appropriate numerical key(s) and then press the ENT button.

MARINE CHANNEL	USA		INTERNATIONAL	
	RECEIVE	TRANSMIT	RECEIVE	TRANSMIT
1	156.050	156.050	160.650	156.050
2	-	-	160.700	156.100
3	156.150	156.150	160.750	156.150
4	156.200	156.200	160.800	156.200
5	156.250	156.250	160.850	156.250
6	156.300	156.300	156.300	156.300
7	156.350	156.350	166.950	156.350
8	156.400	156.400	156.400	156.400
9	156.450	156.450	156.450	156.450
10	156.500	156.500	156.500	156.500
11	156.550	156.550	156.550	156.550
12	156.600	156.600	156.600	156.600
13	156.650	156.650	156.650	156.650
14	156.700	156.700	156.700	156.700
15	156.750	-	156.750	156.750
16	156.800	156.800	156.800	156.800
17	156.850	156.850	156.850	156.850
18	156.900	156.900	161.500	156.900
19	156.950	156.950	161.550	156.950
20	161.600	157.000	161.600	157.000
21	157.050	157.050	161.650	157.050
22	157.100	157.100	161.700	157.100
23	157.150	157.150	161.750	157.150
24	161.800	157.200	161.800	157.200
25	161.850	157.250	161.850	157.250
26	161.900	157.300	161.900	157.300
27	161.950	157.350	161.950	157.350
28	162.000	157.400	162.000	157.400
60	160.625	-	160.625	156.025
61	156.075	156.075	160.675	156.075
62	156.125	156.125	160.725	156.125
63	156.175	156.175	160.775	156.175
64	160.825	-	160.825	156.225
65	156.275	156.275	160.875	156.275
66	156.325	156.325	160.925	156.325
67	156.375	156.375	156.375	156.375
68	156.425	156.425	156.425	156.425
69	156.475	156.475	156.475	156.475
70	156.525	156.525	156.525	156.525
71	156.575	156.575	156.575	156.575
72	156.625	156.625	156.625	156.625

MARINE CH	USA		INTERNATIONAL	
	RECEIVE	TRANSMIT	RECEIVE	TRANSMIT
73	156.675	156.675	156.675	156.675
74	156.725	156.725	156.725	156.725
75	156.875	156.875	156.875	156.875
78	156.925	156.925	161.525	156.925
79	156.975	156.975	161.575	156.975
80	157.025	157.025	161.625	157.025
81	157.075	157.075	161.675	157.075
82	157.125	157.125	161.725	157.125
83	157.175	157.175	161.775	157.175
84	161.825	157.225	161.825	157.225
85	161.875	157.275	161.875	157.275
86	161.925	157.325	161.925	157.325
87	161.975	157.375	161.975	157.375
88	157.425	157.425	162.025	157.425

8. Repeat step 7 (and optional step 5) to program the transceiver to scan as many as ten channels.

4.3 SCANNING

1. After two or more channels have been programmed, press the P/S button for one full second. Observe that the display window indicates which channels are being scanned.

NOTE: Scanning cannot be initiated if the squelch is open.

2. To stop scanning, press the 16, WX (weather), or CLR(clear) button.
3. To resume scanning, press the P/S button for one full second.
4. To keep the transceiver set on a busy channel, depress the CLR button.

4.4 CLEARING A PROGRAMMED SCAN CHANNEL

1. Call the channel up by pressing the P/S button until the channel appears in the display window.
2. Press the U/I button.
3. The channel number will be replaced by two dashes.

5 THEORY OF OPERATION

The electrical descriptions in this section are illustrated by the block diagram, Figure 2, and the schematic diagrams in the Drawing section.

5.1 PHASE-LOCKED LOOP

The phase-locked loop (PLL) frequency synthesizer consists of four major circuits. They are the voltage-controlled oscillator (VCO), PLL local oscillator and mixer, reference oscillator and phase detector, and programmable divider.

The PLL IC, QL01, includes the reference frequency generator, programmable divider, phase detector, and unlock condition detector.

Voltage Controlled Oscillator - The VCO section is composed of varicaps QV03 and QV04, oscillator QV02, buffer QV01, and their associated circuitry. QV04 receives a DC correction voltage through an active low-pass filter, QP30 and QP31. As the DC correction voltage lowers, the capacitance of QV04 increases, thereby lowering the frequency of QV02. QV02 will oscillate at a frequency determined by QV04 and QV03. The formula for determining the VCO frequency, where f_D is frequency desired, is as follows:

$$TX\ VCO = f_D \quad RX\ VCO = f_D - 10.7$$

The output of QV02 is then buffered and amplified by QV01 before proceeding to the next stage.

Mixer and PLL Local Oscillator - The amplified VCO signal is heterodyned with the PLL local oscillator signal originating at transistor QP01, crystals XP03, XP02, and XP01. The frequency of the PLL local oscillator depends on the operation: XP01 is 51.675 MHz for the TX mode, XP02 is 49.460 MHz for the duplex receive mode, XP03 is 48.108 MHz for the simplex receive mode. The output of the PLL local oscillator is then tripled by coil LP05 and applied to the base of the mixer QP41.

The mixer output is the difference between the VCO frequency and the tripled PLL local oscillator frequency. The formula for determining the mixer IF is as follows:

$$M = V_f - (3 \times l_o)$$

Where: M is the mixer IF.

V_f is the VCO frequency desired.

l_o is the PLL local oscillator determined by crystal XP01, XP02, or XP03.

The mixer output signal is amplified by transistors QP42 and QP43 before being applied to pin 56 of IC QL01, which contains the programmable divider.

Programmable Divider - The amplified mixer output signal is fed from QP43 to pin 56 of QL01. Within QL01, the mixer signal is divided according to a hexadecimal code assigned to each channel. The result is a frequency of 6.25 kHz.

Phase Detector and Reference Oscillator - The reference oscillator derives its 150-kHz frequency from crystal XL01. The 150-kHz signal is then divided by 24 within QL01 to obtain a reference frequency of 6.25 kHz.

The phase detector, entirely contained in QL01, compares the 6.25 kHz reference oscillator frequency with the output of the programmable divider. If the signals are in phase, the phase detector output, pin 62 of QL01, will remain a stable DC voltage.

Conversely, when the two signals are out of phase, the DC correction voltage (TP2) will change. When the signals are out of phase the synthesizer is considered to be unlocked. When in the unlocked mode, pin 35 of QL01 activates the unlock circuitry, transistors QE10 and QE06, which disables the transmit B+ supply voltage. This prevents the transmitter from producing RF power output on unassigned frequencies.

5.2 TRANSMITTER

The transmitter is designed to operate in the VHF/FM frequency range of 156.050 to 163.275 MHz at a power output of 1 watt or 5 watts.

Microphone Amplifier - The audio signal originating at the microphone is applied to the preamp QM01, pre-emphasised by QM02 then limited in QM03. The output of QM03 is then filtered by a low pass filter in QM03 then applied to microphone gain control RP68. The signal is then applied to varicap QV03 to modulate the VCO signal.

Amplifier and Driver Stage - The VCO output signal is amplified by transistors QP80 and QT01. The output of QT01 is applied to the driver transistor, QT02. QT01 and QT02 are controlled by the transmit B+ supply. The transmit B+ supply is, in turn, controlled by the unlock signal originating in QL01.

Final Amplifier - The signal received from the small signal and driver stage is applied to

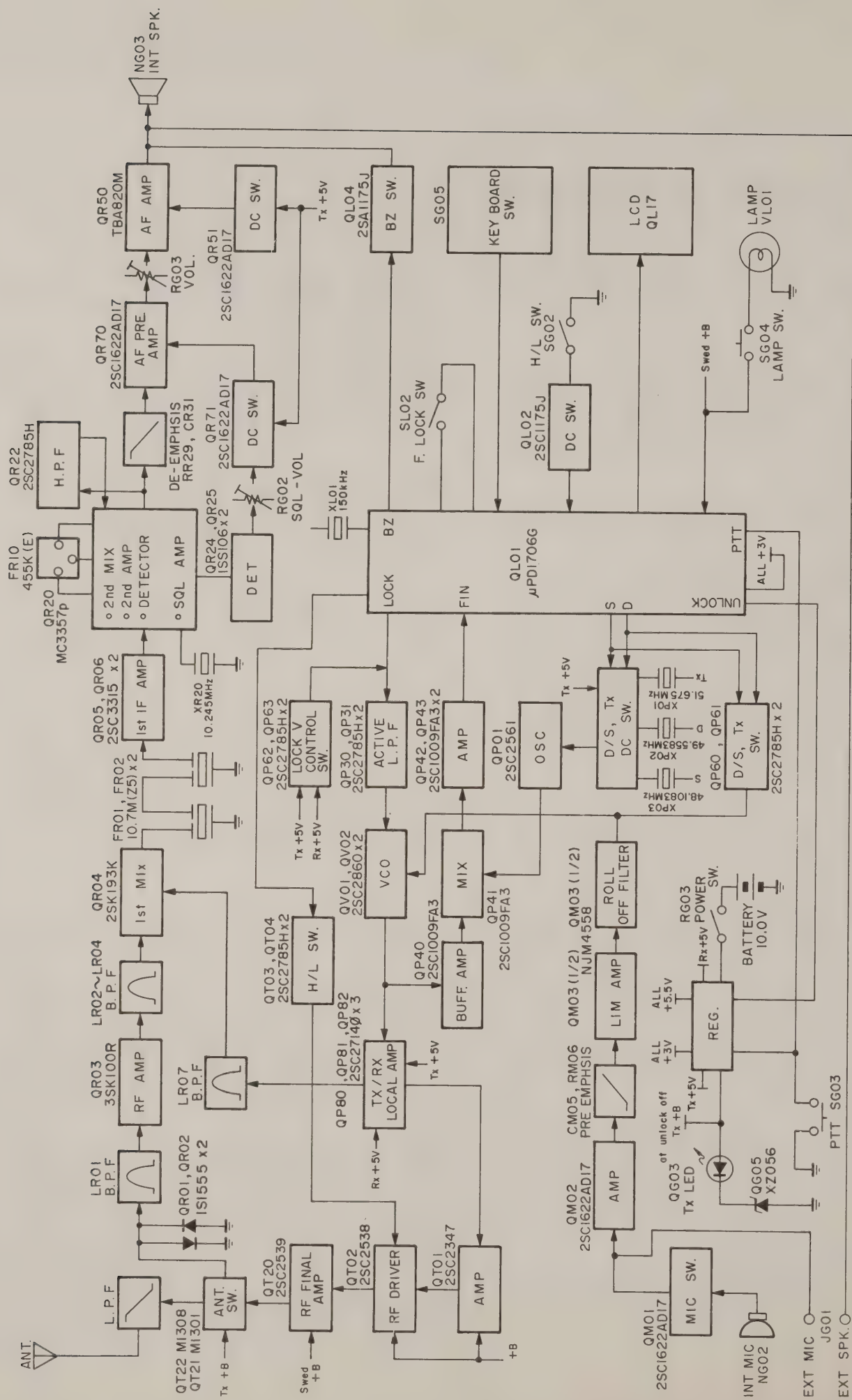


FIGURE 2. HX200SII FUNCTIONAL BLOCK DIAGRAM

class C final amplifier transistor, QT20. QT20 is supplied via the switched B+ supply.

Output Filter/Matching Network - The amplified signal is fed through a 4-stage pi-type filter network to remove unwanted signals and ensure proper antenna matching. Included within the matching network is a solid-state antenna switching network, comprised of diodes QT21 and QT22.

RF Power Switching - The high and low power is accomplished by the switching action of transistors QT03 and QT04. The low power RF output can be adjusted by resistor RT08.

5.3 RECEIVER

The receiver is a double-conversion heterodyne, designed to operate in the VHF/FM frequency range of 156.050 to 163.275 MHz.

RF Stage - An incoming RF signal from the antenna is fed through a bandpass filter and then to gate 1 of a dual-gate MOSFET amplifier, FET QR03. The output is then fed through another bandpass filter.

First Mixer and First Local Oscillator - The amplified and filtered RF signal is applied to the gate of the first mixer, FET QR04, while the first local oscillator signal is injected into the source of QR04. The formula for obtaining the first local oscillator frequency is:

$$f_o = f_{RX} - 10.7 \text{ MHz}$$

Where f_o is the first local oscillator frequency.

Where f_{RX} is the receive frequency.

The first local oscillator signal is derived from the voltage controlled oscillator (VCO). The VCO output is amplified by transistors QP81 and QP82 and filtered by coil LR07 before being applied to the source of QR04.

First and Second IF and Audio Stage - The heterodyning action of the first mixer produces a 10.7 MHz IF, which is applied to a two-stage crystal filter, FR01 and FR02, and then amplified by transistors QR05 and QR06. The amplified IF signal is mixed at IC QR20 with a 10.245 signal from crystal XR20, which produces a 455 kHz second IF. IC QR20 incorporates the functions of the second mixer, second IF amplifier, detector, and noise amplifier into one package.

The audio output of pin 9 on IC QR20 passes through the de-emphasis circuit and is then amplified by the audio pre-amplifier, IC QR70. The amplified audio is then passed through volume control resistor RG03, before being sent to the audio amplifier, IC QR50, to drive the speaker.

Noise Squelch - The noise-actuated squelch circuit consists of a noise detector, diodes QR24 and QR25, noise amplifier and limiter QR20, and DC control circuit, transistor QR71. The signal detected from QR20 by QR24 and QR25 is then applied to the squelch control, resistor RG02. The resultant DC voltage controls the squelch switching transistor QR71. The squelch system eliminates the static which would otherwise be heard at the speaker during the intervals between received signals.

6 MAINTENANCE

6.1 GENERAL

With normal use, the inherent quality of the solid-state components used in the transceiver will provide many years of continuous use without failure.

Precautions - To prevent damage to the transceiver, always observe the following precautions.

1. Never key the transmitter without an antenna or suitable dummy load connected to the antenna socket.
2. Avoid too wide a variance from the specified input voltage. It should not exceed 11.5 VDC nor fall below 8.5 VDC.

Maintenance Sequence - Maintenance on the transceiver should be performed in the following sequence.

1. Conduct the performance test to check the overall performance of the transceiver before the transceiver is sold or installed.
2. Conduct the alignment procedure if the transceiver fails the performance test or whenever a critical electrical component is replaced. The alignment procedure should be repeated whenever maintenance is performed on the transceiver.
3. Follow the troubleshooting charts and measurements to isolate a faulty component whenever the transceiver fails.

6.2 TEST EQUIPMENT

To perform the alignment and test procedures in this section, a technician will require the following, or equivalent, test equipment:

Cushman CE-6A	FM Communications Monitor
Bird 6154	RF Wattmeter with 50-ohm Load
Cushman CE-11	Tone Generator
Hewlett Packard 427A	Voltmeter
Hewlett Packard 11096B	RF Probe
Hewlett Packard 5314A	Frequency Counter
Hewlett Packard 1220A	Oscilloscope
Adjustable, 8V to 13V, 2A ..	Power Supply
Helper Instruments	Sinadder
25 - 0 - 25 uA	Zero Center Meter

The following optional equipment may also be used:

Hewlett Packard 8558B	
with display	RF Spectrum Analyzer
Danometer 2000	Digital Voltmeter
Wavetech 3000	Signal Generator

6.3 PERFORMANCE TEST

Receiver

To test receiver performance, connect the test equipment to the transceiver as detailed in steps 1 through 3, and perform steps 4 through 13.

1. Connect an FM communications monitor to the antenna receptacle.
2. Connect an AC voltmeter to pin 4 and pin 1 of the external microphone jack.
3. Connect a power supply and adjust it to 10.0 VDC.
4. Apply power to the transceiver and turn the squelch control fully counterclockwise (maximum noise).
5. Adjust the volume control for a voltmeter reading of 0.8 VAC.
6. With the communications monitor set at the receive frequency (no modulation), slowly increase a signal level until the voltmeter is reduced to 0.08 VAC (20 dB decrease). Verify that the communications monitor output does not exceed 0.5 uV.
7. Reduce the communications monitor output to zero.
8. Adjust the squelch control to the point where the speaker noise just cuts out (threshold).
9. Set the communications monitor modulation to ± 3 kHz with a 1 kHz tone.
10. Increase the communications monitor output until speaker noise returns. Verify that the output does not exceed 0.25 uV.
11. Turn the squelch control fully clockwise (maximum quieting).
12. Increase the communications monitor output until the audio is recovered at the speaker again. Verify that the signal level of the communications monitor is between 0.5 uV and 5.0 uV.

13. Repeat steps 4 through 12 on several different channels.

Transmitter

To test transmitter performance, connect the test equipment as detailed in steps 1 and 2, and perform steps 3 through 9.

1. Connect a wattmeter with a 50-ohm load to the antenna receptacle.
2. Connect a power supply and adjust it to 10.0 VDC.
3. Apply power to the transceiver and key the transmitter by depressing the microphone push-to-talk switch.
4. Verify that the power output is 5 watts in the high power mode and 1 watt in the low power mode.
5. Set the FM communications monitor to measure the transmitter frequency of the unit.
6. Key the transmitter and verify that the communications monitor indicates the transmitter frequency, ± 500 Hz.
7. Set the communications monitor to measure transmitter deviation.

8. Key the transmitter and speak into the microphone. Deviation must not exceed ± 5.0 kHz.

9. Repeat steps 3 through 8 on several different channels.

6.4 ALIGNMENT

PLL Circuit

To align the PLL circuit, remove the transceiver covers, connect the test equipment as shown in Figure 3, refer to Figure 4 which shows the location of the alignment reference points, and perform the following steps.

PLL Loop Adjustment

1. Set the transceiver to channel 01 in the U (United States) mode.
2. Set the voltmeter for DC volts, and connect it to test point TP02.
3. Key the transmitter and adjust coil LV03 for a voltmeter reading of 1.6 V.
4. In the receive mode, adjust resistor RP67 for a voltmeter reading of 1.6 V.

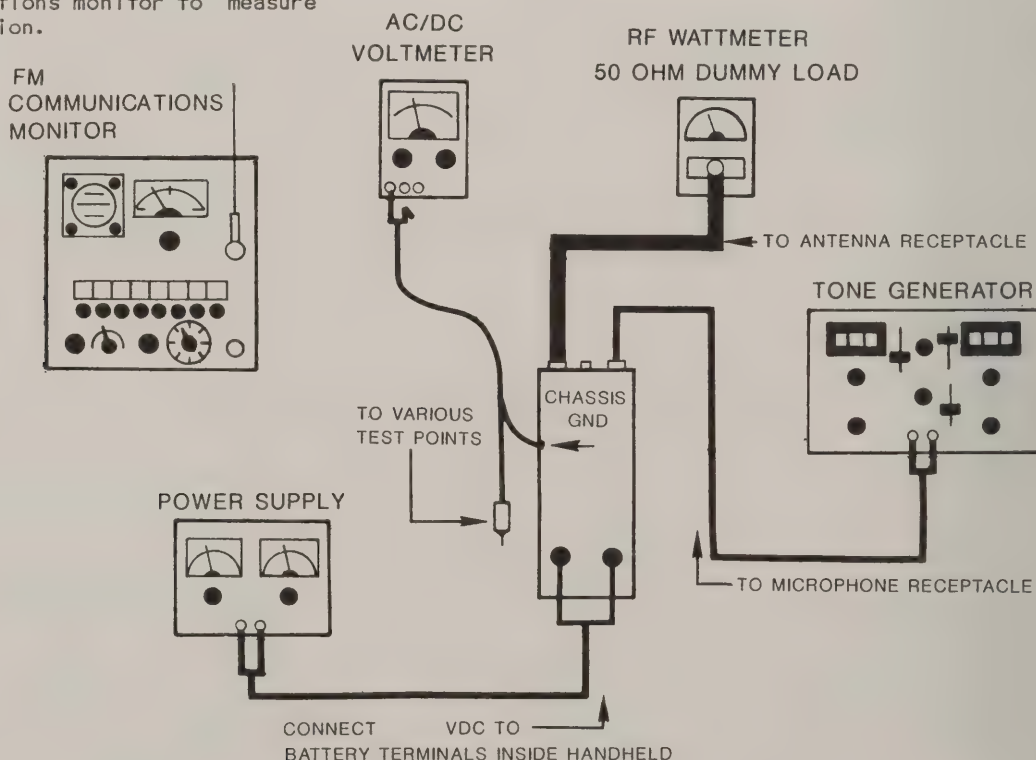


FIGURE 3. HX200SII TEST SETUP

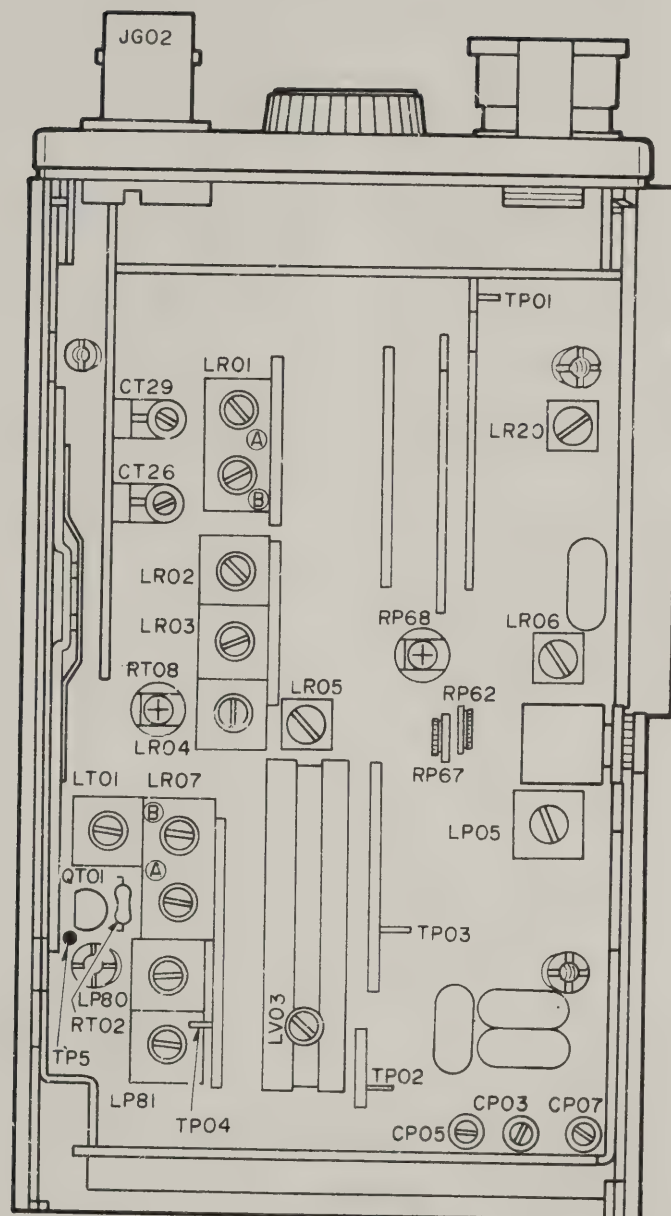


FIGURE 4. HX200SII ALIGNMENT REFERENCE POINTS

5. In the receive mode, set the transceiver to channel 01 in the I (International) mode and adjust resistor RP62 for a voltmeter reading of 1.6 V.
6. Disconnect the voltmeter from test point TP02. Connect an RF voltmeter to test point TP03.
7. Set the transceiver to channel 16. Ground the secondary side of LP81 to prevent interference from the VCO. Adjust LP05 so that the level of TP03 is the same in both the receive and transmit modes.
8. Disconnect the RF voltmeter from test point TP03.
9. Connect the frequency counter to test point TP04.
10. Set the transceiver to the I mode.
11. In the receive mode, set the transceiver to channel 16 and adjust capacitor CP07 for 146.100 MHz.
12. In the transmit mode, set the transceiver to channel 16 and adjust capacitor CP03 for 156.800 MHz.
13. In the receive mode, set the transceiver to channel 01 adjust capacitor CP05 for 149.950 MHz.
14. Disconnect the frequency counter from test point TP04.

Transmitter

To align the transmitter, remove the transceiver covers, connect the test equipment as shown in Figure 3, refer to Figure 4 which shows the location of the alignment reference points, and perform the following steps.

1. Set the high/low power switch to the HI position and set the transceiver to channel 16, transmit mode.
2. Set the voltmeter for DC volts, connect it to test point TP05, and adjust coil LP81 for the minimum voltmeter reading.
3. Turn RT08 fully counterclockwise.
4. Adjust LT01, CT26, and CT29 to obtain the maximum wattmeter reading.
5. Adjust coil LT20 to obtain maximum wattmeter reading.
6. Repeat steps 4 and 5. Make sure that the output power is more than 5 watts.
7. Switch the high/low power switch to the LO position and adjust resistor RT08 for a wattmeter reading of 0.75 watt.
8. Connect an external microphone to the radio. Open the microphone, disconnect the wire from the microphone element, and connect it to a tone generator set for a 1 kHz, 20 mV tone. Adjust RP68 so that the deviation becomes ± 4.5 kHz.

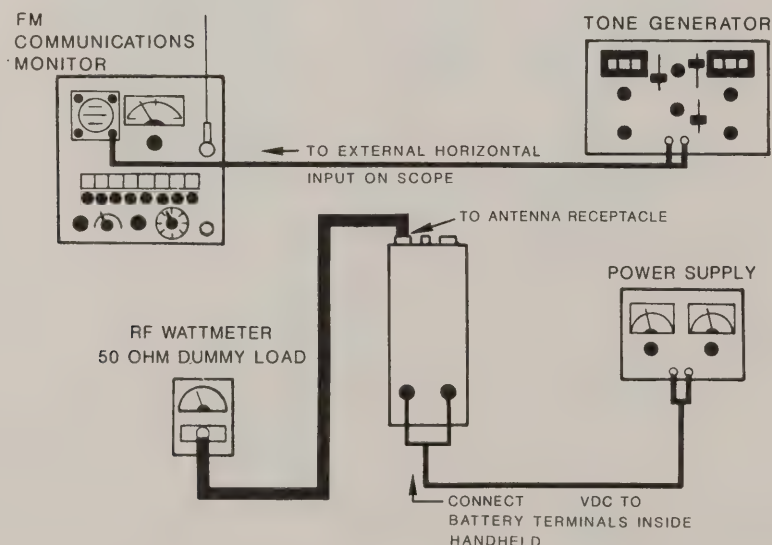


FIGURE 5. HX200SII RX TEST SETUP

9. Reduce the tone generator output until the deviation becomes ± 3.5 kHz. Then, increase the tone generator output by 20 dB.
10. Adjust RP68 so that the deviation becomes ± 4.5 kHz.

Receiver

To align the receiver, remove the transceiver covers, connect the test equipment as shown in Figure 5, refer to Figure 4 which shows the location of the alignment reference points, and perform the following steps.

1. Connect an RF signal generator to the antenna connector. Connect an 8-ohm dummy load, millivoltmeter, and oscilloscope to the external speaker terminal.
2. Set the voltmeter for DC volts and connect it to test point TP01.
3. Set the transceiver to channel WX04 and adjust coils LR01(A), LR01(B), LR02, LR04, LR05, LR06, LP80, LR07(A), and LR07(B) for the maximum voltmeter reading.

4. Adjust LR03 so that the slug is 1.5 turns up from its bottom position.
5. Set the transceiver to channel 06. Adjust LR04, LR07(B), and LR07(A) in succession for a peak AC voltmeter reading.
6. Adjust LR20 for a peak audio output.

NOTE: For the following steps 7 and 8, set the RF signal generator output from 0.20 to 0.25 μ V.

7. Set the transceiver to channel WX04. Adjust CP05 for maximum 12 dB SINAD sensitivity.
8. Set the transceiver to channel 06. Adjust CP07 for maximum 12 dB SINAD sensitivity.

6.5 TROUBLESHOOTING

Only after the transceiver has been aligned to the desired frequency should the following troubleshooting charts be used (in conjunction with the troubleshooting measurement charts on the appropriate schematic in the Drawings section) to isolate a defective stage or component.

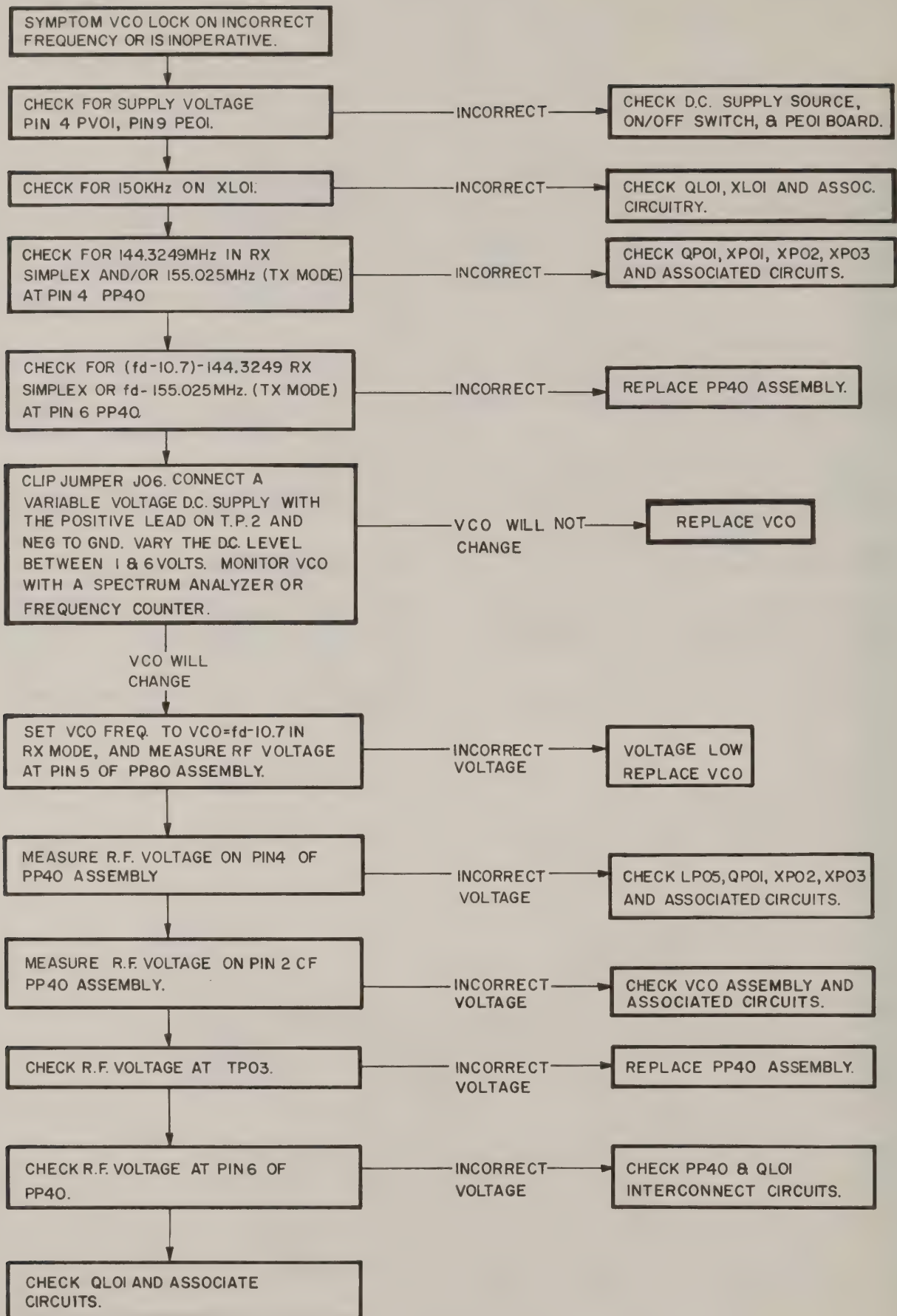


FIGURE 6. HX200SII PLL TROUBLESHOOTING CHART



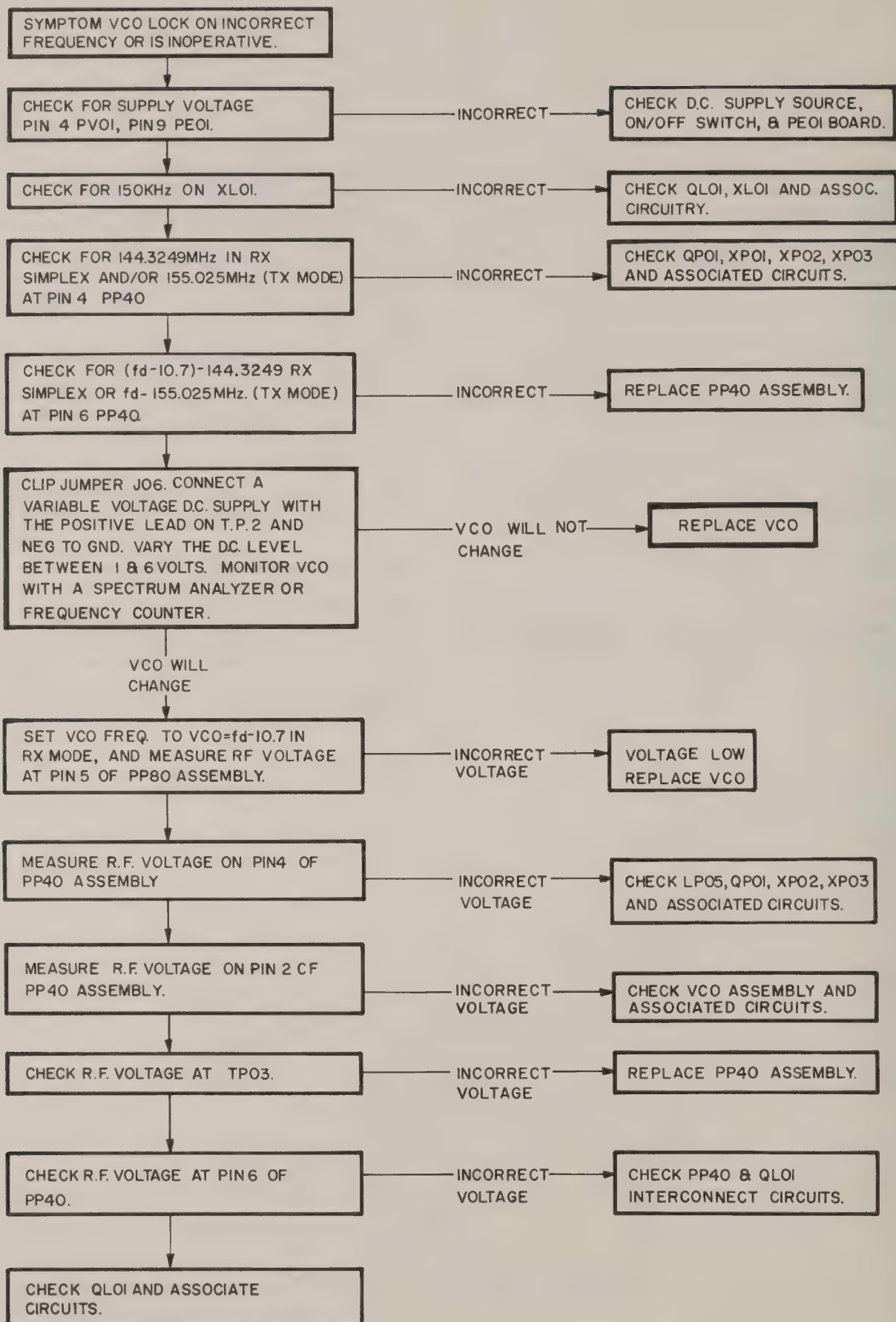


FIGURE 6. HX200SII PLL TROUBLESHOOTING CHART

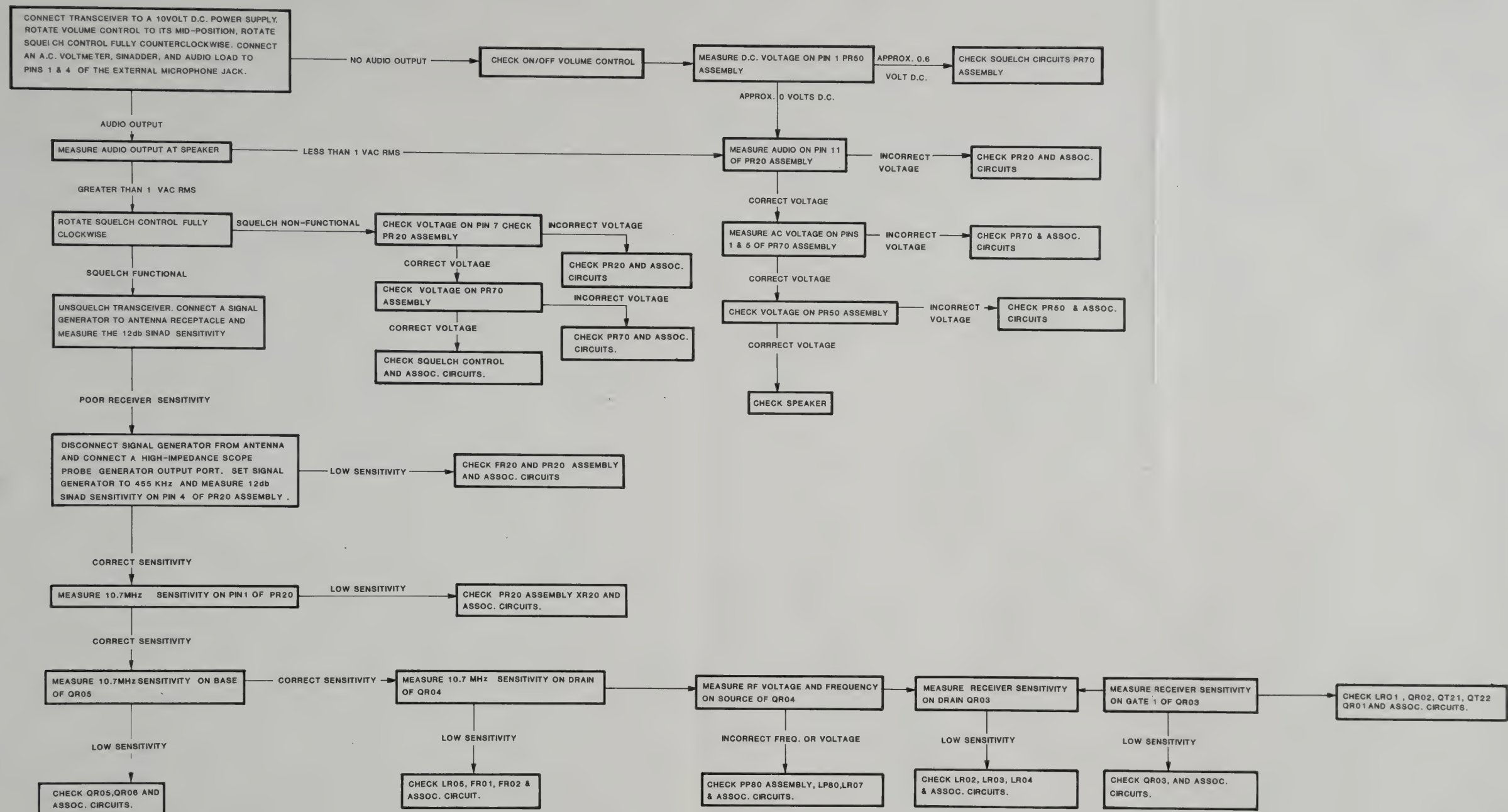


FIGURE 7. HX200SII RX TROUBLESHOOTING CHART

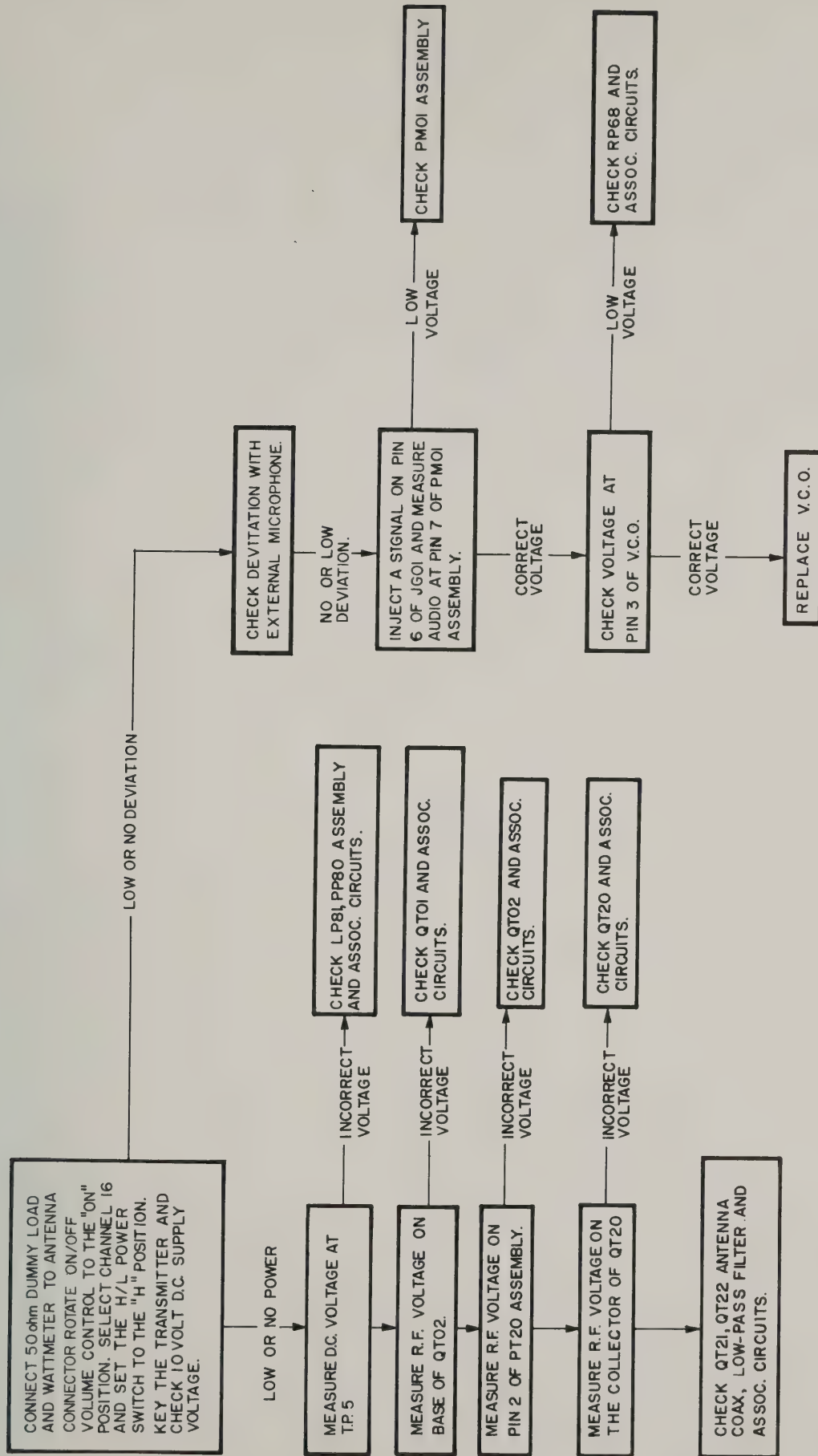


FIGURE 8. HX200SII TX TROUBLESHOOTING CHART

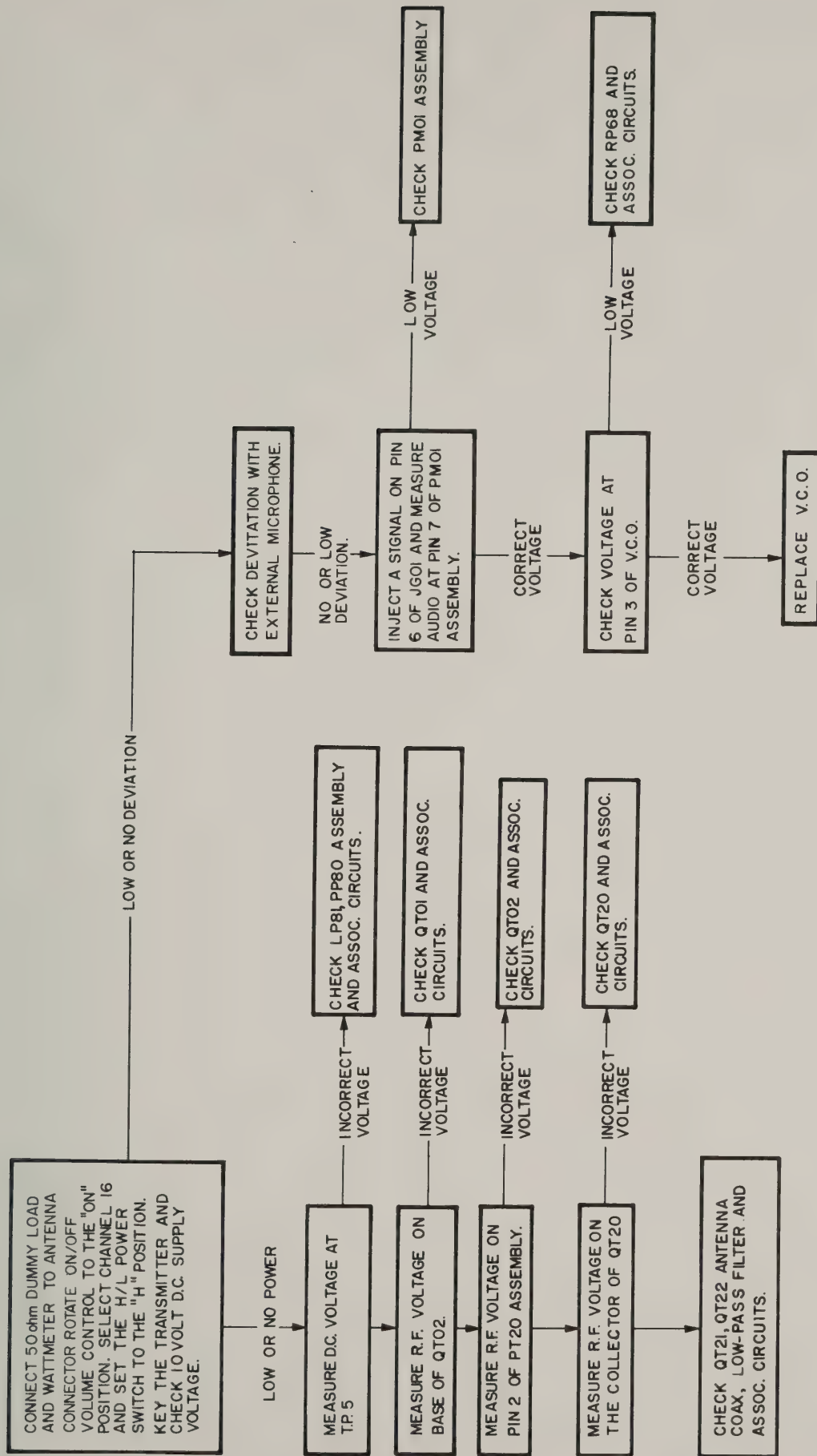


FIGURE 8. HX200SII TX TROUBLESHOOTING CHART

7 DRAWINGS

7.1 GENERAL

The drawings in this section show the electrical and mechanical parts locations and interconnections of the transceiver. The values of most electrical parts are indicated on the schematic diagrams. Troubleshooting measurements are listed in charts on the schematic.

7.2 REVISIONS

As drawings are updated, parts changes which are not compatible with all versions of the transceiver are detailed in a revision list printed on the back of the applicable drawing. Organized chronologically by model serial number, each revision list includes: the reference designators of the part, a description of the revision, and the serial number of the first unit that incorporates the change.

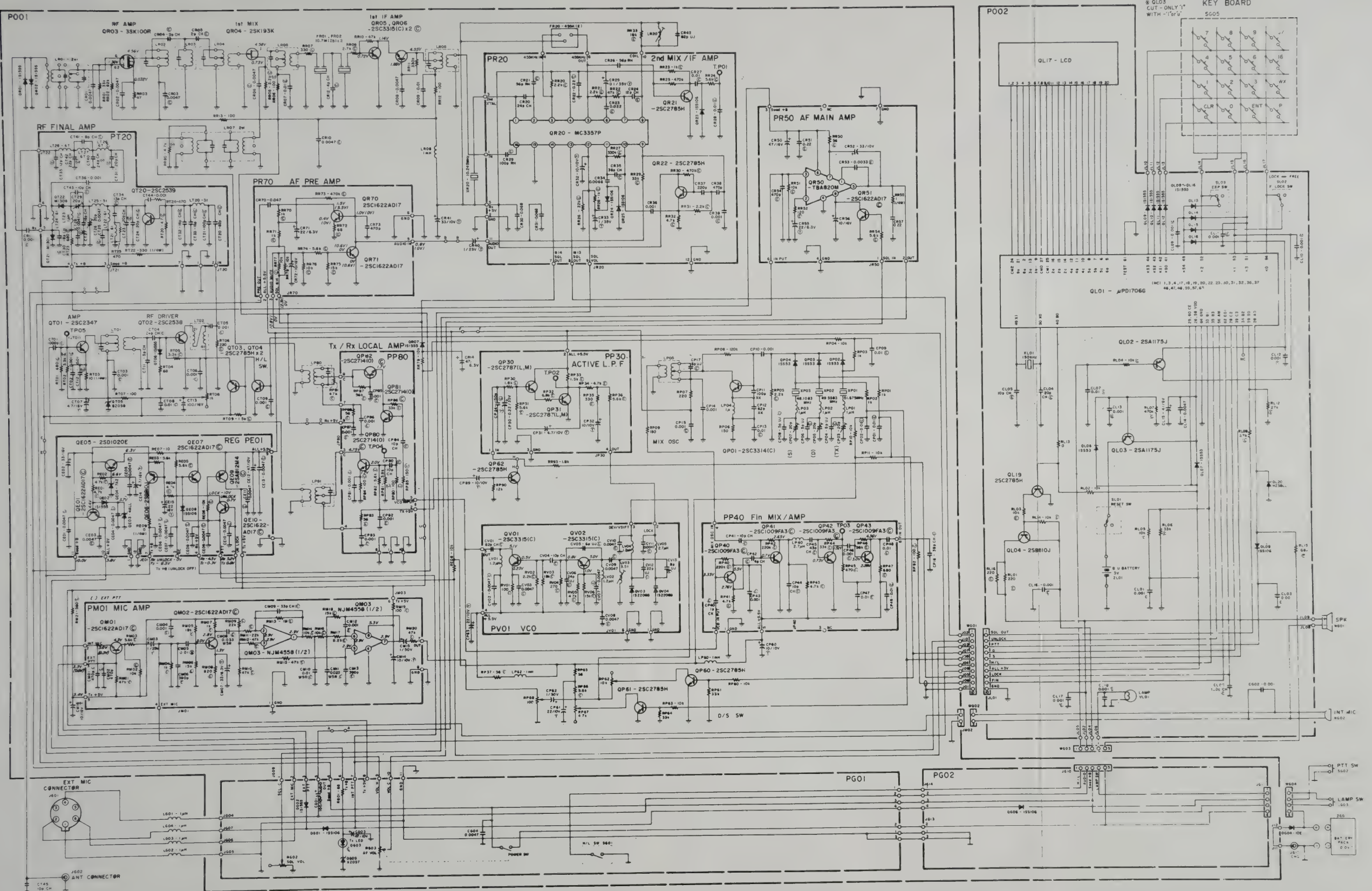
7 DRAWINGS

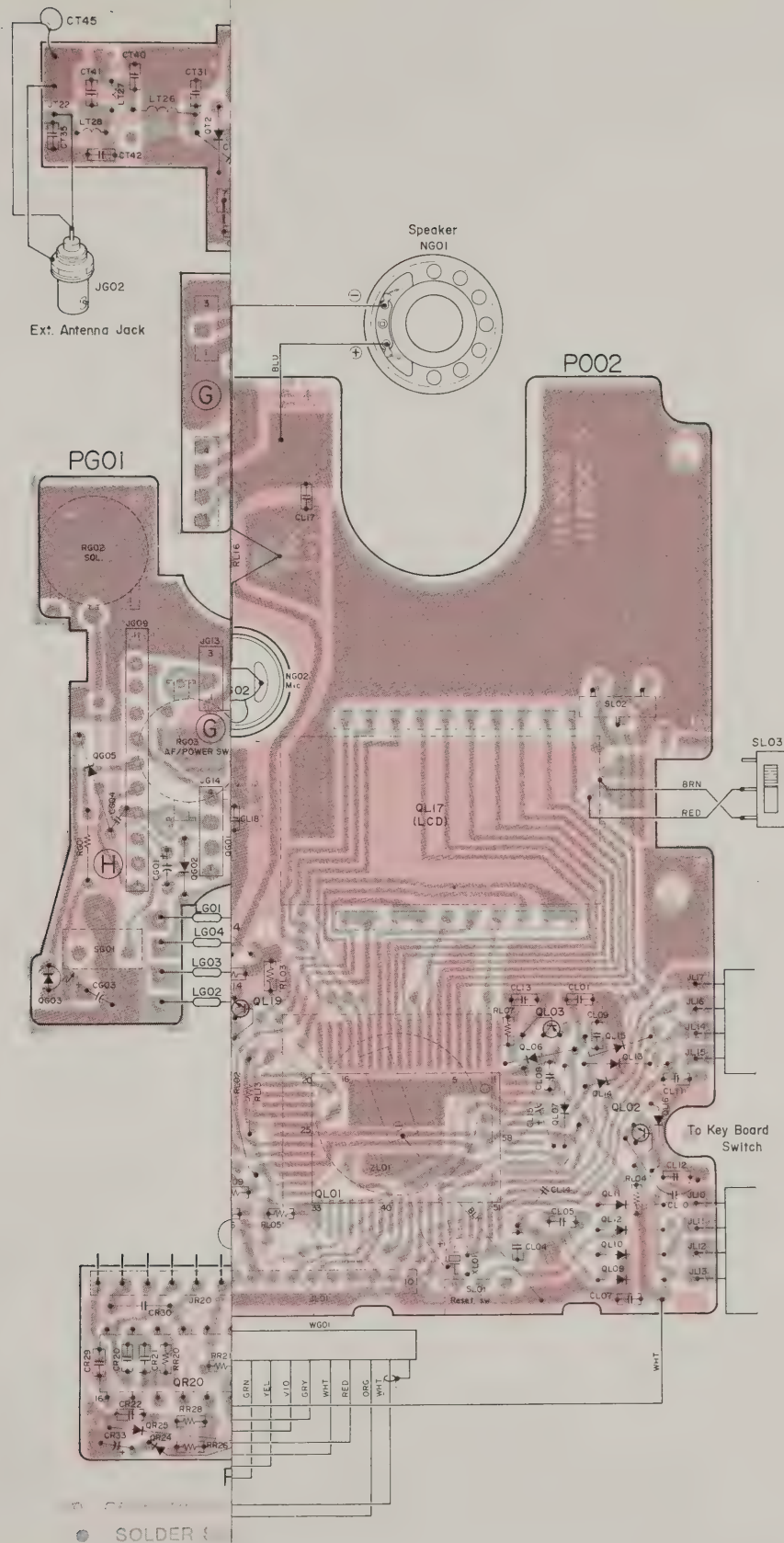
7.1 GENERAL

The drawings in this section show the electrical and mechanical parts locations and interconnections of the transceiver. The values of most electrical parts are indicated on the schematic diagrams. Troubleshooting measurements are listed in charts on the schematic.

7.2 REVISIONS

As drawings are updated, parts changes which are not compatible with all versions of the transceiver are detailed in a revision list printed on the back of the applicable drawing. Organized chronologically by model serial number, each revision list includes: the reference designators of the part, a description of the revision, and the serial number of the first unit that incorporates the change.





10. P.C.BOARD LAYOUT
(SIDE with COMPONENT OVERLAY)

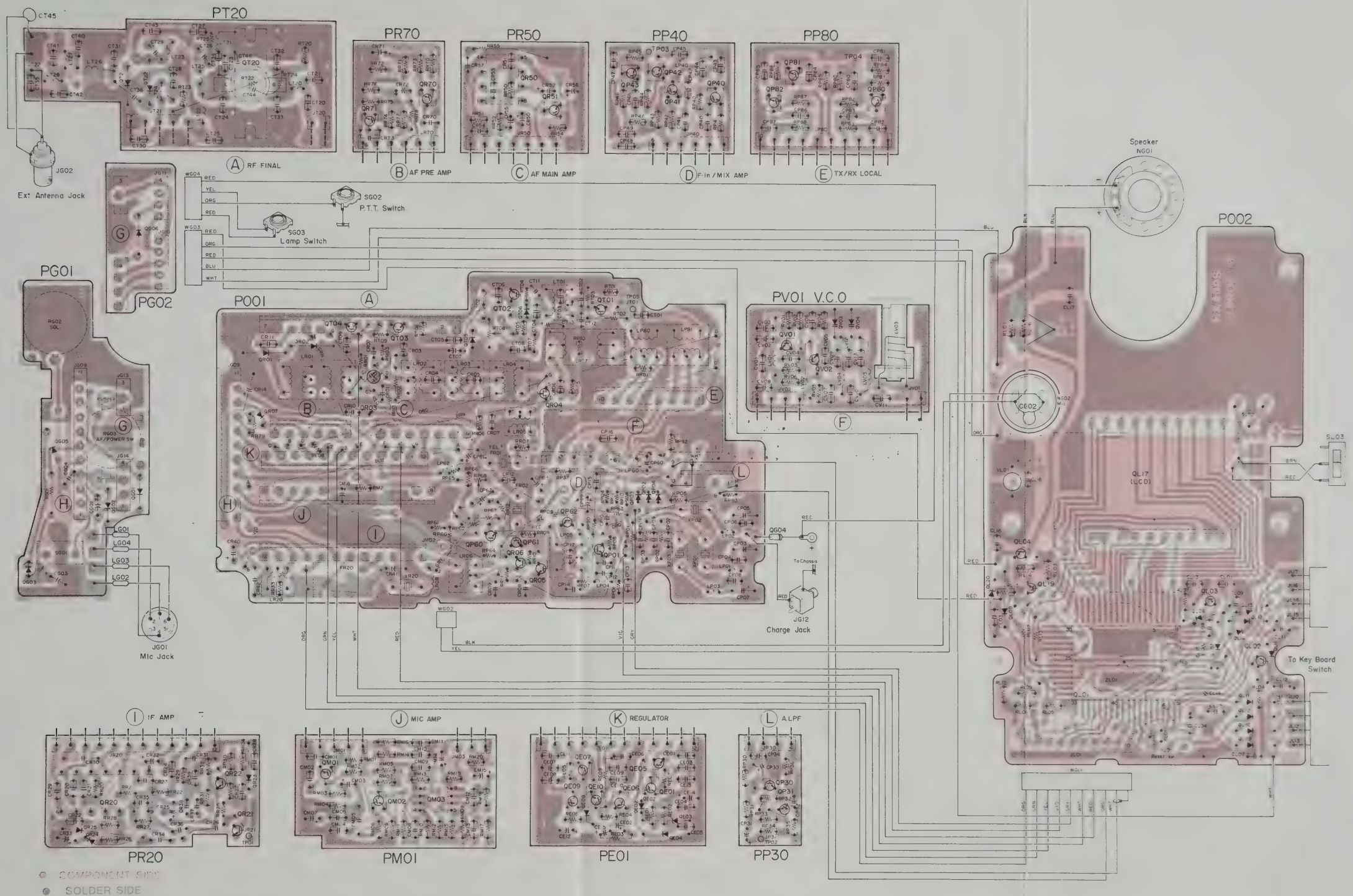


FIGURE 10. P.C. BOARD LAYOUT
(SOLDER SIDE with COMPONENT OVERLAY)

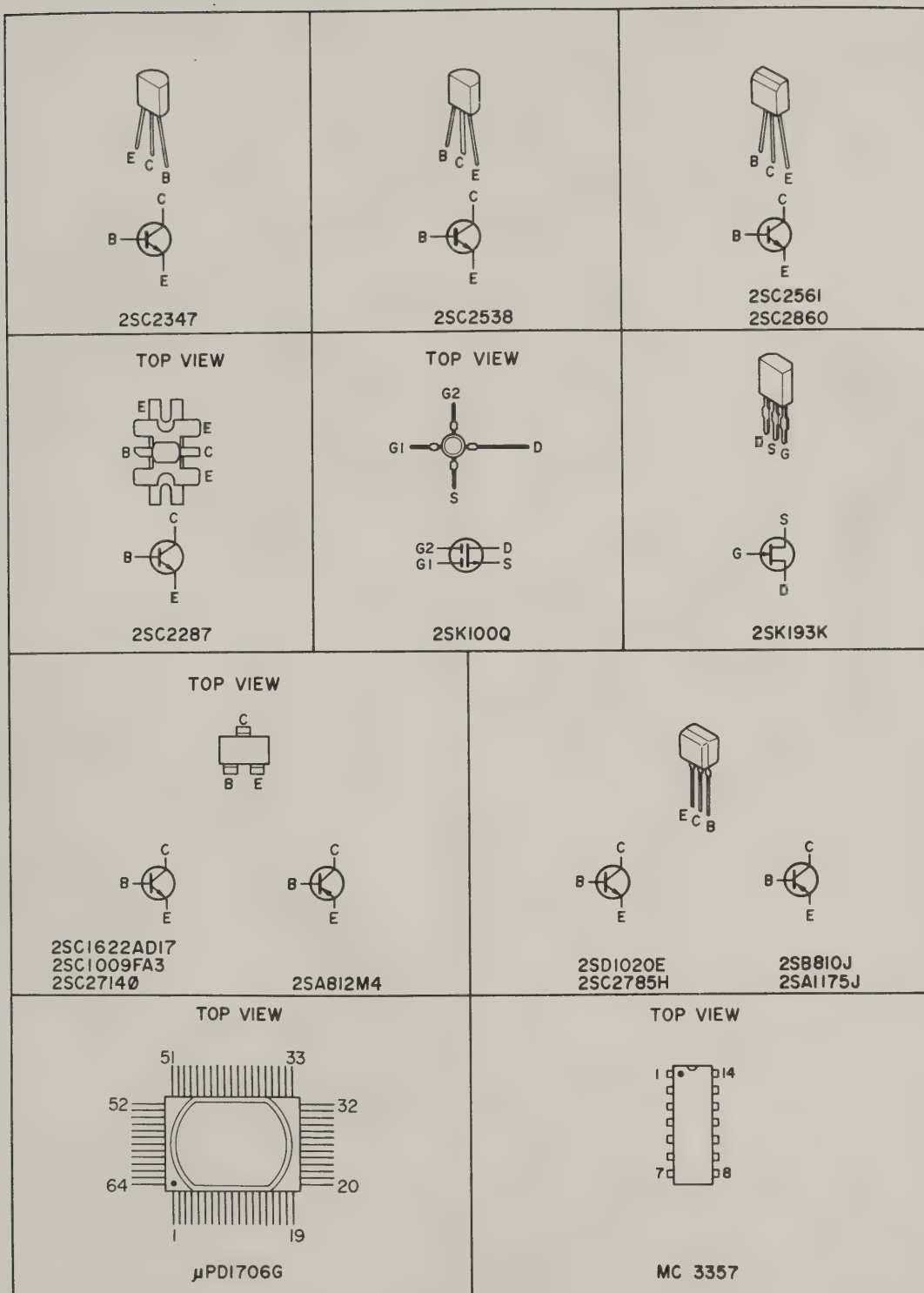


FIGURE 11. HX200SII SEMICONDUCTOR PIN DETAILS

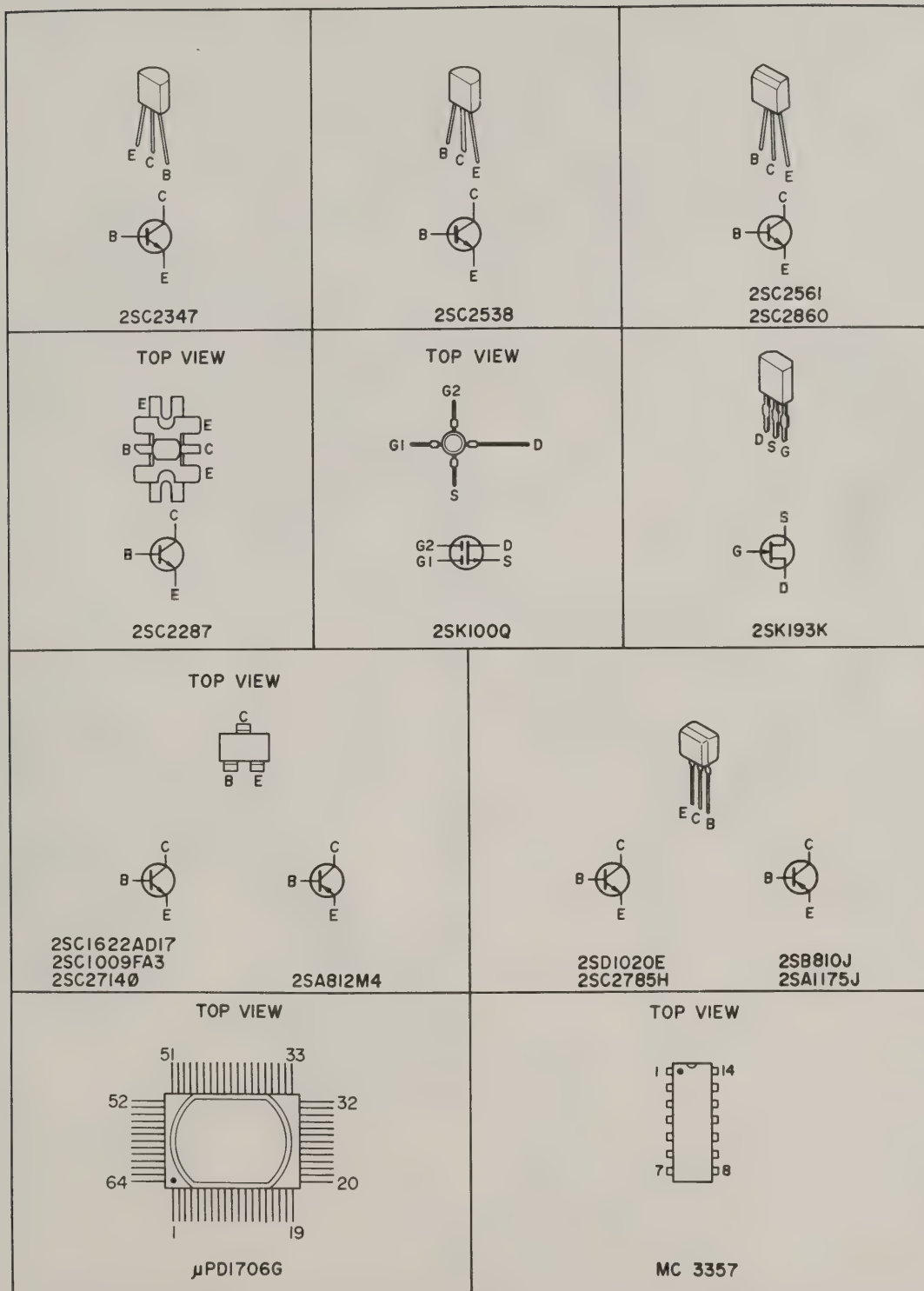


FIGURE 11. HX200SII SEMICONDUCTOR PIN DETAILS

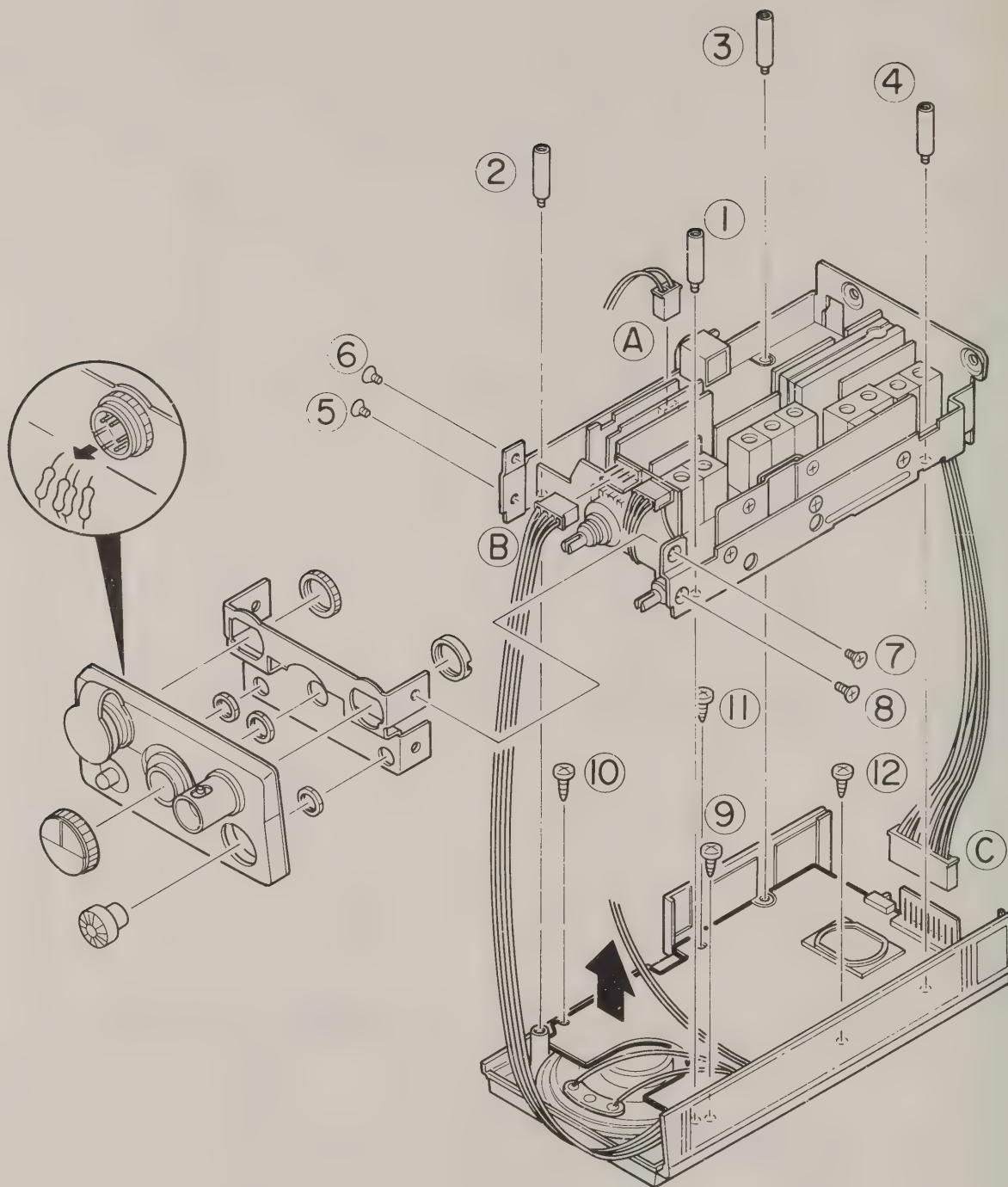


FIGURE 12. HX200SII CHASSIS ASSEMBLY



8 PARTS LIST

8.1 GENERAL

Information on significant mechanical parts and all electrical parts, excepting common resistors, is included in the parts lists. Parts in each list are listed by reference designators in alphanumeric order. Those parts which share the same value and SCC part number are grouped together.

Because it is more economical to replace certain minor P.C. boards rather than service them, they are offered as assemblies and their parts are not listed. The piece parts of minor P.C. boards that can be economically serviced are listed along with their assembly part number.

8.2 ORDERING REPLACEMENT PARTS

Standard Communications Corp. (SCC) may not be able to fill replacement parts orders that are without such identifying information as: reference designator, value, description, part number, and unit model number.

To replace orders, phone the SCC Parts Department at (213) 532-5300, extension 301, or write:

SCC Parts Department
P.O. Box 92151
Los Angeles, CA 90009-2151

Crystals or crystal filters must be ordered through the Frequency Management Department, at the number listed above, extension 251, or the above address.

8.3 REVISIONS

Parts lists apply to parts in the current build of the transceiver as of the printing date. Revision lists (found in the Drawings section) catalog the parts in previous builds of the transceiver which cannot be replaced by the parts in the current parts lists.

Reference Designator	Description	SCC Part Number
Capacitors		
CE01	Ceramic, 0.0047 uF	DK46472300
CE02	Electrolytic, 33 uF, 16 V	EJ33601610
CE03	Ceramic, 0.0047 uF	DK46472300
CE04	Ceramic, 0.0047 uF	DK46472300
CE05	Ceramic, 0.0047 uF	DK46472300
CE06	Ceramic, 0.0047 uF	DK46472300
CE07	Ceramic, 0.0047 uF	DK46472300
CE08	Ceramic, 0.0047 uF	DK46472300
CE09	Ceramic, 0.0047 uF	DK46472300
CE10	Ceramic, 0.0047 uF	DK46472300
CE11	Ceramic, 0.0047 uF	DK46472300
CE12	Electrolytic, 47 uF, 10 V	EJ47601010
CE13	Ceramic, 0.0047 uF	DK46472300
CE14	Electrolytic, 4.7 uF, 16 V	EV47501600
CE15	Electrolytic, 22 uF, 16 V	EV22601660
CG01	Electrolytic, 100 uF, 10 V	EA10701010
CG02	Ceramic, 0.001 uF	DK16102300
CG03	Electrolytic, 47 uF, 10 V	EA47601010
CG04	Ceramic, 0.0047 uF	DK18472310
CL01	Ceramic, 0.001 uF	DK46102300
CL03	Ceramic, 0.001 uF	DK46102300
CL04	Ceramic, 20 pF, CH	DD45200300
CL05	Ceramic, 10 pF, CH	DD41100300
CL07	Ceramic, 0.01 uF	DK46103300
CL08	Ceramic, 150 pF, CH	DD45151300
CL09	Ceramic, 0.001 uF	DK46102300
CL10	Ceramic, 0.001 uF	DK16102300
CL11	Ceramic, 0.001 uF	DK46102300
CL12	Ceramic, 0.001 uF	DK46102300
CL13	Ceramic, 0.001 uF	DK46102300
CL14	Ceramic, 0.0047 uF	DA17472010
CL15	Electrolytic, 47 uF, 6 V	EV47600660
CL16	Ceramic, 0.001 uF	DK46102300
CL17	Ceramic, 0.001 uF	DK46102300
CL18	Ceramic, 0.001 uF	DK46102300
CM01	Ceramic, 470 pF	DK46471300
CM02	Ceramic, 470 pF	DK46471300
CM03	Electrolytic, 1 uF, 25 V	EV10502560
CM04	Ceramic, 0.001 uF	DK46102300
CM05	Semiconductor, 0.01 uF	DS17103010
CM06	Ceramic, 390 pF	DK46391300
CM07	Electrolytic, 33 uF, 6.3 V	EV33600660
CM08	Ceramic, 0.033 uF	DK48333300
CM09	Ceramic, 33 pF, CH	DD45330300
CM10	Ceramic, 0.01 uF	DK46103300
CM11	Ceramic, 0.022 uF	DK48223300
CM12	Ceramic, 0.001 uF	DK46102300
CM13	Ceramic, 390 pF	DK46391300
CM14	Electrolytic, 10 uF, 10 V	EV10601060
CM15	Electrolytic, 1 uF, 50 V	EJ10505010
CM16	Electrolytic, 10 uF, 10 V	EV10601660
CP01	Ceramic, 0.01 uF	DK46103300
CP02	Ceramic, 0.01 uF	DK46103300
CP03	Trimming, 20 pF	CT12000130
CP04	Ceramic, 5 pF	DD40050360
CP05	Trimming, 20 pF	CT12000130

Reference Designator	Description	SCC Part Number
005B	Cover	109C053060
006B	Nut, S.C.	53228059E0
007B	Nut, S.C.	53228119E2
008B	Cover, PTT	412C053060
009B	Cover	412C053070
015B	Chassis	412C105020
016B	Packing	412C277020
017B	Holder	412C271010
018B	Guide	111C051020
019B	Stopper	111C114020
020B	Spring	111C115010
021B	Screw, P.H. Tap	51302606D0
022B	Battery Contactor	111C123010
023B	Buffer	111C056010
024B	Screw, P.H.M.	51060206E0
025B	Battery Contactor Lug	62021030W0
026B	Nut, Hexagon	53110203E0
030B	Clamper	412C005020
031B	Heatsink	412C267020
032B	Screw, P.H.M.	51040203A0
033B	Screw, P.H.M.	51040204A0
036B	Screw, P.H.M.	51040203A0
038B	Sticker	412C122020
039B	Button	412C270010
040B	Collar	412C055010
041B	Spring	412C115020
045B	Window, LED	412C158010
046B	Window, LCD	412C158020
047B	Sticker	412C122010
048B	Sheet	412C107010
049B	Bushing	412C259010
050B	Knob	412C154030
051B	Retainer	412C104030
052B	Button	412C270020
058B	Screw, P.H. Tap	51302606B0
059B	Support	412C101010
060B	Case	412C064020
061B	Screw, P.H.M.	51080206L0
063B	Packing	412C277080
064B	Retainer	412C104020
065B	Packing	412C277060
070B	Support	412C101020
101B	Cover, Top	412C053080
102B	Case	412C064010
103B	Indicator	412C265120
201B	Battery Case	111C064050
202B	Battery Lid	412C257010
204B	Lock	111C102010
205B	Screw, F.H. Tap.	51502606D0
206B	Packing	034C277010
207B	Packing	034C277020
250B	Indicator	412C265020
001F	Shield	412C109020
002F	Shield	412C109030
003F	Shield	412C109040
004F	Buffer	412C056020
005F	Buffer	412C056010
006F	Insulator	412C120050

Reference Designator	Description	SCC Part Number
RV02	Chip, 2.2 k	RI05222180
RV03	Chip, 18 k	RI05183180
RV04	Chip, 270	RI05271180
RV05	Chip, 4.7 k	RI05472180
RV06	Chip, 15 k	RI05153180

Miscellaneous

FR01	Crystal, 10.7 MHz	XU410700S5
FR02	Crystal, 10.7 MHz	XU410700S5
FR20	Filter, 455K	FG455306E0
FT01	Core, T6X2X3	FC50068C10
JE01	Plug, 12-pin	YP07001110
JG01	Jack, 6-pin	YJ10001600
JG02	Jack, Antenna	YJ10001620
YJ09	Plug, 11-pin	YP07001100
YG10	Plug, 5-pin	YP07001160
YG11	Plug, 4-pin	YP07001150
YG12	Jack, Connector	YJ01001020
YG13	Plug, 3-pin	YP07001230
YG14	Plug, 4-pin	YP07001240
JL01	Plug, 10-pin	YP07001210
JM01	Plug, 5-pin	YP07001040
JM02	Plug, 2-pin	YP07001130
JM03	Plug, 3-pin	YP07001020
JP30	Plug, 4-pin	YP07001030
JP40	Plug, 7-pin	YP07001050
JP80	Plug, 10-pin	YP07001090
JR20	Plug, 12-pin	YP07001110
JR50	Plug, 7-pin	YP07001060
JR70	Plug, 6-pin	YP07001050
JT20	Plug, 2-pin	YP07001010
JT21	Plug, 5-pin	YP07001040
JV01	Plug, 2-pin	YP07001010
JV02	Plug, 4-pin	YP07001030
NG01	Speaker	QK00458010
NG02	Microphone Unit	MS50000150
SG01	Switch	SC01020450
SG02	Switch, PTT	SP01010580
SG03	Switch, Lamp	SP01010580
SG05	Switch, Keyboard	SK08160010
SL01	Switch, Reset	SS01020410
SL02	Switch, F-lock	SS01020440
SL03	Switch, Exp	SS01020410
VL01	Lamp, 9V-45MA	IN10090070
WG01	Cord, Connective	YB01002150
WG02	Cord, Connective, 2-pin	YB01002190
WG03	Cord, Connective	YB01002170
WG04	Cord, Connective	YB01002160
XL01	Crystal, 105 kHz	XM001002B3
XP01	Crystal, 51.67 MHz	XB301048G2
XP02	Crystal, 49.5583 MHz	XB301052G2
XP03	Crystal, 48.1083 MHz	XB301050G2
XR20	Crystal, 10.245 MHz	XA21024504
001B	Packing	412C277070
002B	Chassis	412C105010
003B	Knob, Squelch	412C154010
004B	Knob, Volume	412C154020

Reference Designator	Description	SCC Part Number
RP84	Chip, 100	RI05101180
RP85	Chip, 150	RI05151180
RP86	Chip, 33 k	RI05333180
RP87	Chip, 56 k	RI05563180
RP88	Chip, 56	RI05560180
RP90	12 k , 1/6 W	GD05123160
RP92	Chip, 100	RI05101180
RP93	1.8 k , 1/6 W	GD05182160
RR01	33 k , 1/6 W	GD05333160
RR02	82 k , 1/6 W	GD05823160
RR03	47 , 1/6 W	GD05470160
RR05	Chip, 2.2 k	RI05222180
RR06	Chip, 100	RI05101180
RR07	Chip, 330	RI05331180
RR09	Chip, 2.7 k	RI05272180
RR10	47 k , 1/6 W	GD05473160
RR11	330 k , 1/6 W	GD05334160
RR12	100 k , 1/6 W	GD05101160
RR13	100 k , 1/6 W	GD05101160
RR20	Chip, 2.2 k	RI05222180
RR21	Chip, 2.2 k	RI05222180
RR22	Chip, 47 k	RI05473180
RR23	Chip, 1 k	RI05102180
RR24	Chip, 5.6 k	RI05562180
RR25	470 k , 1/6 W	GD05474160
RR26	Chip, 22 k	RI05223180
RR27	Chip, 330 k	RI05334180
RR28	Chip, 1.0 k	RI05102180
RR29	Chip, 33 k	RI05333180
RR30	Chip, 470 k	RI05474180
RR31	Chip, 2.2 k	RI05222180
RR32	Chip, 4.7 k	RI05472180
RR33	Chip, 18 k	RI05183180
RR50	Chip, 56	RI05560180
RR51	Chip, 10 k	RI05103180
RR52	Chip, 120	RI05121180
RR54	Chip, 5.6 k	RI05562180
RR70	Chip, 1 k	RI05102180
RR71	Chip, 1 k	RI05102180
RR72	Chip, 68	RI05680180
RR73	Chip, 470 k	RI05474180
RR74	Chip, 5.6 k	RI05562180
RR75	Chip, 15 k	RI05153180
RR76	Chip, 10 k	RI05103180
RR77	Chip, 10 k	RI05103180
RR78	10 k , 1/6 W	GD05103160
RR79	10 k , 1/6 W	GD05103160
RR80	Chip, 4.7 k	RI05472180
RR81	Chip, 4.7 k	RI05472180
RT01	Chip, 680	RI05681180
RT02	3.3 k , 1/6 W	GD05332160
RT04	68	GD05680160
RT05	Chip, 3.3 k	RI05332180
RT06	Chip, 220	RI05221180
RT08	Trimming, 1 k	RA01020370
RT09	Chip, 1.5 k	RI05152180
RT20	Chip, 47	RI05470180
RT23	Chip, 680	RI05681180
RT25	470 , 1/6 W	GD05471160
RV01	Chip, 100	RI05101180

Reference Designator	Description	SCC Part Number
RM02	Chip, 10 k	RI05103180
RM03	Chip, 5.6 k	RI05562180
RM04	Chip, 1 k	RI05102180
RM05	Chip, 18 k	RI05183180
RM06	Chip, 15 k	RI05153180
RM07	Chip, 1 k	RI05102180
RM08	Chip, 820	RI05821180
RM09	Chip, 22 k	RI05223180
RM10	Chip, 47 k	RI05473180
RM11	Chip, 22 k	RI05223180
RM12	Chip, 47 k	RI05473180
RM13	Chip, 1 M	RI05105180
RM14	Chip, 10 k	RI05103180
RM15	Chip, 47 k	RI05473180
RM16	Chip, 10 k	RI05103180
RM17	Chip, 8.2 k	RI05822180
RM18	Chip, 15 k	RI05153180
RM19	Chip, 100	RI05101180
RM20	Chip, 47 k	RI05473180
RM21	Chip, 560	RI05561180
RP01	1 k , 1/6 W	GD05102160
RP02	1 k , 1/6 W	GD05102160
RP03	1 k , 1/6 W	GD05102160
RP04	10 k , 1/6 W	GD05103160
RP05	Chip, 2.2 k	RI05222180
RP06	150 , 1/6 W	GD05151160
RP07	220 , 1/6 W	GD05221160
RP08	120 k , 1/6 W	GD05124160
RP09	Kanon, 180 , 1/8 W	NB51813360
RP10	10 k , 1/6 W	GD05103160
RP11	10 k , 1/6 W	GD05103160
RP30	Chip, 1.8 k	RI05182180
RP31	Chip, 5.6 k	RI05562180
RP32	Chip, 6.8 k	RI05682180
RP33	Chip, 1.5 k	RI05152180
RP34	Chip, 4.7 k	RI05472180
RP35	Chip, 330	RI05331180
RP36	Chip, 5.6 k	RI05582180
RP37	Chip, 56	RI05560180
RP40	Chip, 220 k	RI05224180
RP41	Chip, 4.7 k	RI05472180
RP42	Chip, 220 k	RI05224180
RP43	Chip, 4.7 k	RI05472180
RP44	Chip, 33 k	RI05333180
RP45	Chip, 470	RI05471180
RP46	Chip, 56 k	RI05563180
RP47	Chip, 680	RI05681180
RP60	10 k , 1/6 W	GD05103160
RP61	33 k , 1/6 W	GD05333160
RP62	Trimming, 10 k	RA01030610
RP63	10 k , 1/6 W	GD05103160
RP64	33 k , 1/6 W	GD05333160
RP65	56 , 1/6 W	GD05560167
RP66	Chip, 5.6 k	RI05562180
RP67	Trimming, 4.7 k	RA04720150
RP68	Trimming, 100	RA01010110
RP80	Chip, 100	RI05101180
RP81	Chip, 3.9 k	RI05392180
RP82	Chip, 5.6 k	RI05562180
RP83	Chip 56	RI05560180

Reference Designator	Description	SCC Part Number
QR06	Transistor, 2SC3315C	HT33315100
QR07	Diode, 1S1555	HD20011050
QR20	IC, MC3357P	HC10015170
QR21	Transistor, 2SC2785H	HT327851H0
QR22	Transistor, 2SC2785H	HT327851H0
QR23	Diode, 1SS106	HD20016010
QR24	Diode, 1SS106	HD20016010
QR25	Diode, 1SS106	HD20016010
QR50	IC, TBA820M	HC10017110
QR51	Chip, 2SC1622AD17	HX316221A0
QR70	Chip, 2SC1622AD17	HX316221A0
QR71	Chip, 2SC1622AD17	HX316221A0
QT01	Transistor, 2SC2347	HT32347100
QT02	Transistor, 2SC2538	HT32538100
QT03	Transistor, 2SC2785H	HT327851H0
QT04	Transistor, 2SC2785H	HT327851H0
QT05	Zener, BZ058	HD30058090
QT06	Diode, 1S1555	HD20011050
QT20	Transistor, 2SC2539	HT32539010
QT21	Diode, M1301	HD20001200
QT22	Diode, M1308	HD20006200
QV01	Transistor, 2SC3315C	HT33315100
QV02	Transistor, 2SC3315C	HT33315100
QV03	Varicap, 1S2208B	HD40002060
QV04	Varicap, 1S2208B	HD40002060

Resistors

Unless otherwise noted, all chip resistors in this parts list are valued at 1/8 W, +5%. All resistance values are in ohms. Resistors not listed in this parts list are composed of carbon film and valued at 1/4 W, +5%. The resistance values of those resistors not listed are on the schematic diagram.

RE01	Chip, 2.7 k	RI05472180
RE02	Chip, 4.7 k	RI05472180
RE03	5.6 k, 1/6 W	GD05562160
RE04	Chip, 1.8 k	RI05182180
RE05	Chip, 5.6 k	RI05562180
RE06	Chip, 10 k	RI05103180
RE07	10 , 1/6 W	GD05100160
RE08	10 k , 1/6 W	GD05103160
RG01	68 , 1/6 W	GD05680160
RG02	Variable, Squelch Volume	RB02030160
RG03	Variable, Volume Switch	RB12030150
RL01	Chip, 220	RI05221180
RL02	10 k , 1/6 W	GD05103160
RL03	Chip, 10 k	RI05103180
RL04	Chip, 10 k	RI05103180
RL05	Chip, 10 k	RI05103180
RL06	Chip, 33 k	RI05333180
RL07	Chip, 470 k	RI05474180
RL09	Chip, 22 k	RI05223180
RL12	Chip, 27 k	RI05273180
RL14	Chip, 10 k	RI05103180
RL15	Chip, 68 k	RI05683180
RL16	Chip, 220	RI05221180
RM01	Chip, 47 k	RI05473180

Reference Designator	Description	SCC Part Number
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Semiconductors

QE01	Chip, 2SC1622AD17	HX316221A0
QE02	Diode, 1S1555	HD20011050
QE03	Zener, 3.6-3.8 V	HD30040010
QE04	Zener, 7A2	HD30015010
QE05	Transistor, 2SD1020E	HT410201E0
QE06	Transistor, 2SB810J	HT208101J0
QE07	Chip, 2SC1622AD17	HX316221A0
QE08	Diode, 1SS106	HD20016010
QE09	Chip, 2SA812M4	HX108121A0
QE10	Chip, 2SC1622AD17	HX316221A0
QG01	Diode, 1SS106	HD20016010
QG02	Diode, 1S1555	HD20011050
QG03	L.E.D., TX	HT12019080
QG04	Diode, 10E1	HD20023100
QG05	Zener, XZ057	HD30040060
QG06	Diode, 1SS106	HD20016010
QL01	IC, UPD1706G	HC10068060
QL02	Transistor, 2SA1175J	HT111751J0
QL03	Transistor, 2SA1175J	HT111751J0
QL04	Transistor, 2SB810J	HT210101J0
QL06	Diode, 1SS53	HD20010060
QL07	Diode, 1SS53	HD20010060
QL08	Diode, 1SS106	HD20016010
QL09	Diode, 1S1555	HD20011050
QL10	Diode, 1S1555	HD20011050
QL11	Diode, 1S1555	HD20011050
QL12	Diode, 1S1555	HD20011050
QL13	Diode, 1S1555	HD20011050
QL14	Diode, 1S1555	HD20011050
QL15	Diode, 1S1555	HD20011050
QL16	Diode, 1S1555	HD20011050
QL17	LCD Display Unit	HQ20303050
QL19	Transistor, 2SC2785H	HT327851H0
QL20	Zener, HZ3BLL	HD30016010
QM01	Chip, 2SC1622AD17	HX316221A0
QM02	Chip, 2SC1622AD17	HX316221A0
QM03	IC, NJM4558	HC10011090
QP01	Transistor, 2SC3314B	HT333141B0
QP02	Diode, 1SS53	HD20010060
QP03	Diode, 1SS53	HD20010060
QP04	Diode, 1SS53	HD20010060
QP30	Transistor, 2SC2787	HT327872A0
QP31	Transistor, 2SC2787	HT327872A0
QP40	Chip, 2SC1009FA3	HX310091A0
QP41	Chip, 2SC1009FA3	HX310091A0
QP42	Chip, 2SC1009FA3	HX310091A0
QP43	Chip, 2SC1009FA3	HX310091A0
QP60	Transistor, 2SC2785H	HT327851H0
QP61	Transistor, 2SC2785H	HT327851H0
QP62	Transistor, 2SC2785H	HT327851H0
QP80	Chip, 2SC2714C	HX327141B0
QP81	Chip, 2SC2714C	HX327141B0
QP82	Chip, 2SC2714C	HX327141B0
QR01	Diode, 1S1555	HD20011050
QR02	Diode, 1S1555	HD20011050
QR03	F.E.T., 3SK100R	HF401001R0
QR04	F.E.T., 2SK193K	HF201931R0
QR05	Transistor, 2SC3315C	HT33315100

Reference Designator	Description	SCC Part Number
CT45	Ceramic, 10 pF, CH	DD11100300
CV01	Ceramic, 82 pF, CH	DD45820300
CV02	Ceramic, 0.0047 uF	DK46472300
CV03	Ceramic, 0.0047 uF	DK46472300
CV04	Ceramic, 10 pF, CH	DD41100300
CV05	Ceramic, 6 pF	DD41060360
CV06	Ceramic, 24 pF	DD45240360
CV07	Ceramic, 0.0047 uF	DK46472300
CV08	Ceramic, 0.0047 uF	DK46472300
CV09	Ceramic, 0.0047 uF	DK46472300
CV10	Ceramic, 0.0047 uF	DK46472300
CV11	Ceramic, 0.0047 uF	DK46472300
CV12	Ceramic, 22 pF	DD45220360
CV13	Ceramic, 8 pF	DD41080360

Inductors

LG01	Coil, Choke, 1 uH	LC11020070
LG02	Coil, Choke, 1 uH	LC11020070
LG03	Coil, Choke, 1 uH	LC11020070
LG04	Coil, Choke, 1 uH	LC11020070
LP01	Coil, Choke, 1 uH	LC11020020
LP02	Coil, Choke, 1 uH	LC11020020
LP03	Coil, Choke, 1 uH	LC11020020
LP04	Coil, Choke, 1 uH	LC11020020
LP05	Coil, Antenna	LA70196120
LP40	Coil, Choke, 2.7 uH	LC12720080
LP60	Coil, Choke, 1 MH	LC11050040
LP62	Coil, Choke, 1 MH	LC11050040
LP80	Coil, Antenna	LA70350060
LP81	Coil, Antenna	LA70280070
LR01	Coil, Antenna	LA70016080
LR02	Coil, Antenna	LA70016100
LR03	Coil, Antenna	LA70016110
LR04	Coil, Antenna	LA70016120
LR05	I.F.T., 10.7 M	LI50006010
LR06	I.F.T., 10.7 M	LI50006010
LR07	Coil, Antenna	LA70260050
LR08	Coil, Choke 1 MH	LC11050040
LR20	Coil, I.F.T., Quadrature	LI50069020
LT01	Coil, Antenna, 150 MHz	LA70280070
LT02	Coil, Antenna	LF50130020
LT20	Coil, Choke, 3 T	LC12800010
LT21	Coil, Choke, 6 T	LC15000010
LT22	Coil, Choke, 6 T	LC15000010
LT23	Coil, Choke, 1 uH	LC11020070
LT24	Coil, Choke, 6 T	LC15000010
LT25	Coil, Choke, 5 T	LC14000010
LT26	Coil, Choke, 6 T	LC15000010
LT27	Coil, Choke, 6 T	LC15000010
LT28	Coil, Choke, 6 T	LC15000010
LV01	Coil, Choke, 1.2 uH	LC11220030
LV02	Coil, Choke, 1.2 uH	LC11220030
LV03	Coil, Antenna, 31/2 T	LA70350050
LV04	Coil, Choke, 1.2 uH	LC11220030
LV05	Coil, Choke, 2.7 uH	LC12720080

Reference Designator	Description	SCC Part Number
CR28	Ceramic, 0.01 uF	DK46103300
CR29	Ceramic, 100 pF, RH	DD45101330
CR30	Ceramic, 0.068 uF	DK26683010
CR31	Ceramic, 0.068 uF	DK26683010
CR32	Electrolytic, 10 uF, 10 V	EV10601060
CR33	Electrolytic, 1 uF, 35 V	EV10503560
CR34	Ceramic, 0.0068 uF	DK26682010
CR35	Ceramic, 36 pF, CH	DD45360300
CR36	Ceramic, 0.001 uF	DK16102300
CR37	Ceramic, 220 pF	DK16221300
CR38	Ceramic, 470 pF	DK16471300
CR39	Ceramic, 0.001 uF	DK46102300
CR40	Electrolytic, 1 uF, 25 V	EV10502560
CR41	Electrolytic, 33 uF, 10 V	EV33601060
CR42	Ceramic, 82 pF	DD15820360
CR50	Electrolytic, 47 uF, 16 V	EJ47601610
CR51	Ceramic, 0.22 uF	DK48224300
CR52	Electrolytic, 33 uF, 10 V	EJ33601010
CR53	Ceramic, 0.0033 uF	DK46332300
CR54	Ceramic, 470 pF	DK46471300
CR55	Electrolytic, 22 uF, 6.3 V	EV22600660
CR56	Electrolytic, 10 uF, 16 V	EJ10601610
CR57	Ceramic, 0.22 uF	DK27224010
CR70	Ceramic, 0.047 uF	DK26473010
CR71	Electrolytic, 22 uF, 6.3 V	EJ22600610
CR72	Electrolytic, 10 uF, 16 V	EJ10601610
CR73	Ceramic, 470 pF	DK16471300
CT01	Ceramic, 0.001 uF	DK46102300
CT02	Ceramic, 0.001 uF	DK46102300
CT03	Ceramic, 0.001 uF	DK46102300
CT04	Ceramic, 24 pF, CH	DD45240300
CT05	Ceramic, 0.001 uF	DK46102300
CT06	Ceramic, 0.001 uF	DK46102300
CT07	Electrolytic, 4.7 uF, 16 V	EV47501660
CT08	Ceramic, 0.01 uF	DK46103300
CT09	Ceramic, 0.001 uF	DK46102300
CT11	Ceramic, 5 pF, CH	DD10050300
CT12	Ceramic, 0.01 uF	DK46103300
CT13	Electrolytic, 100 uF, 16 V	EA10701610
CT20	Ceramic, 82 pF, CH	DD45820300
CT21	Ceramic, 100 pF, CH	DD45101300
CT23	Ceramic, 20 pF, CH	DD45200300
CT24	Ceramic, 20 pF, CH	DD45200300
CT25	Ceramic, 0.0047 uF	DK46472300
CT26	Trimming, 20 pF	CT12000150
CT27	Ceramic, 10 pF, CH	DD45180300
CT28	Ceramic, 0.0047 uF	DK46472300
CT29	Trimming, 20 pF	CT12000150
CT30	Ceramic, 18 pF, CH	DD45180300
CT31	Ceramic, 20 pF, CH	DD45200300
CT32	Ceramic, 15 pF, CH	DD45150300
CT33	Ceramic, 15 pF, CH	DD45150300
CT34	Ceramic, 13 pF, CH	DD45130300
CT35	Ceramic, 12 pF, CH	DD45120300
CT36	Ceramic, 0.001 uF	DK16102300
CT40	Ceramic, 24 pF, CH	DD45240300
CT41	Ceramic, 8 pF, CH	DD41080300
CT42	Ceramic, 22 pF, CH	DD45220300
CT43	Ceramic, 10 pF, CH	DD41100300
CT44	Ceramic, 0.001 uF	DK16102300

Reference Designator	Description	SCC Part Number
CP06	Ceramic, 5 pF	DD40050360
CP07	Trimming, 20 pF	CT12000130
CP08	Ceramic, 5 pF	DD40050360
CP09	Ceramic, 0.01 uF	DK46103300
CP10	Ceramic, 0.001 uF	DK16102300
CP11	Ceramic, 100 pF	DD15101050
CP12	Ceramic, 62 pF	DD15620010
CP13	Ceramic, 0.01 uF	DK46103300
CP14	Ceramic, 0.001 uF	DK16102300
CP15	Ceramic, 0.001 uF	DK46102300
CP16	Ceramic, 39 pF	DD45390300
CP17	Ceramic, 8 pF	DD41080360
CP30	Electrolytic, 0.22 uF, 35 V	EV22403560
CP31	Electrolytic, 4.7 uF, 10 V	EV47501060
CP32	Electrolytic, 10 uF, 10 V	EV10601060
CP34	Ceramic, 150 pF, CH	DD45151300
CP40	Ceramic, 1 pF, CK	DD40010300
CP41	Ceramic, 10 pF, CH	DD41100300
CP42	Ceramic, 4 pF, CH	DD40040300
CP43	Ceramic, 0.001 uF	DK46102300
CP44	Ceramic, 10 pF, CH	DD41100300
CP45	Ceramic, 43 pF, CH	DD45430300
CP46	Ceramic, 0.001 uF	DK46102300
CP47	Ceramic, 0.01 uF	DK46103300
CP48	Ceramic, 0.01 uF	DK46103300
CP49	Ceramic, 0.01 uF	DK46103300
CP60	Electrolytic, 10 uF, 10 V	EV10601060
CP61	Electrolytic, 22 uF, 10 V	EV22601060
CP62	Electrolytic, 1 uF, 50 V	EJ10505010
CP63	Electrolytic, 22 uF, 10 V	EV22601060
CP80	Ceramic, 10 pF, CH	DD41100300
CP81	Ceramic, 0.001 uF	DK46102300
CP82	Ceramic, 0.001 uF	DK46102300
CP83	Ceramic, 0.001 uF	DK46102300
CP84	Ceramic, 10 pF, CH	DD41100300
CP85	Ceramic, 0.001 uF	DK46102300
CP86	Ceramic, 0.001 uF	DK46102300
CP87	Ceramic, 0.001 uF	DK46102300
CP89	Electrolytic, 10 uF, 10 V	EV10601060
CR01	Ceramic, 0.0047 uF	DK18472310
CR02	Ceramic, 0.0047 uF	DK18472310
CR03	Ceramic, 0.0047 uF	DK46472300
CR04	Ceramic, 5 pF, CH	DD40050300
CR05	Ceramic, 2 pF, CK	DD40020300
CR06	Ceramic, 0.0047 uF	DK46472300
CR07	Ceramic, 0.01 uF	DK46103300
CR08	Ceramic, 0.0047 uF	DK18472310
CR09	Ceramic, 0.01 uF	DK78103010
CR10	Ceramic, 0.0047 uF	DK46472300
CR11	Ceramic, 0.001 uF	DK46102300
CR12	Ceramic, 4 pF, CH	DD40040300
CR14	Electrolytic, 47 uF, 6 V	EV47600660
CR20	Ceramic, 24 pF, CH	DD45240300
CR21	Ceramic, 56 pF, RH	DD45560330
CR22	Ceramic, 0.22 uF	DK48224300
CR23	Ceramic, 0.022 uF	DK48223300
CR24	Ceramic, 12 pF, CH	DD45120300
CR25	Electrolytic, 0.1 uF, 35 V	EV10403560
CR26	Ceramic, 56 pF, RH	DD15560330
CR27	Ceramic, 0.01 uF	DK46103300

Reference Designator	Description	SCC Part Number
007F	Insulator	412C120060
008F	Insulator	412C120070
009F	Insulator	412C120080
010F	Buffer	412C056030
015F	Insulator	412C120110
020F	Insulator	412C120120
021F	Sticker	412C122030
022F	Buffer	412C056040
023F	Insulator	412C120060
024F	Insulator	412C120050
025F	Insulator	412C120130
026F	Insulator	412C120140
027F	Insulator	412C120150
028F	Insulator	057C120010



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E067 386 1K S/M

HX220S

Hand-Phone 6
6 Watt VHF/FM
Marine Radio

Contains:

- ☐ Specifications
- ☐ FCC Information
- ☐ Operation
- ☐ Installation
- ☐ Theory of Operation
- ☐ Performance Tests
- ☐ Alignment Procedure
- ☐ Troubleshooting Charts
- ☐ Complete Drawings
- ☐ Parts Lists

Service Manual

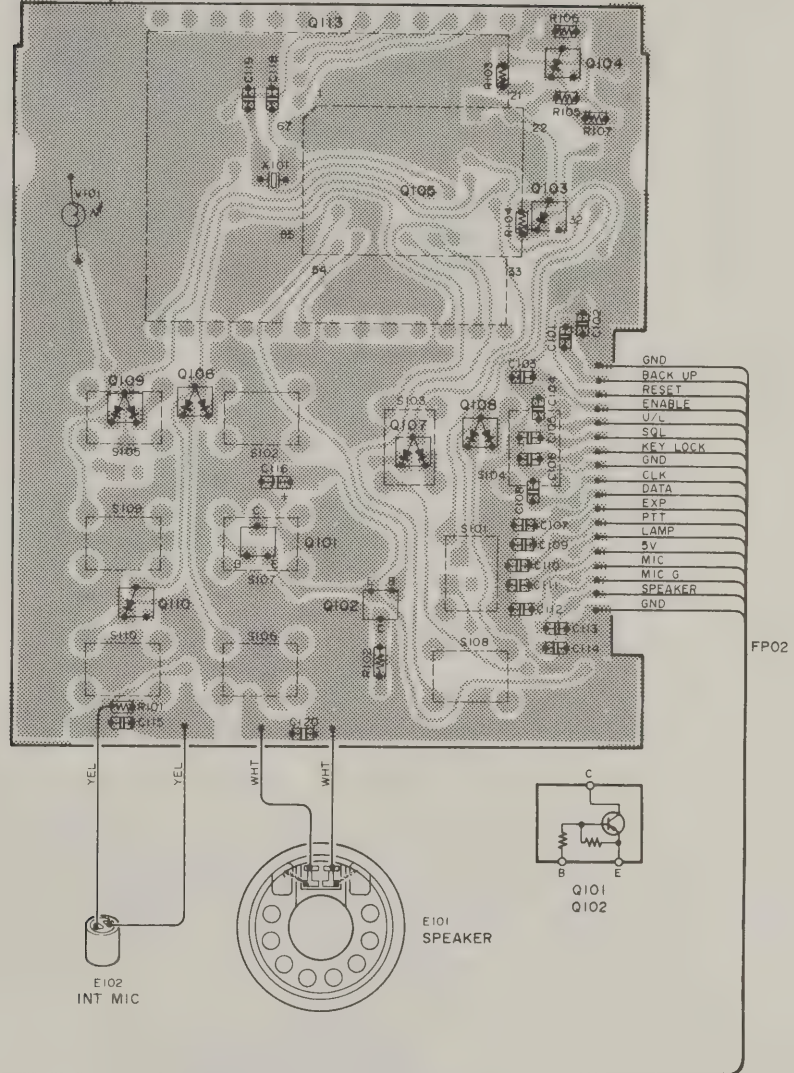


Standard Communications Corp. **Inserts**

HX220S SERVICE MANUAL

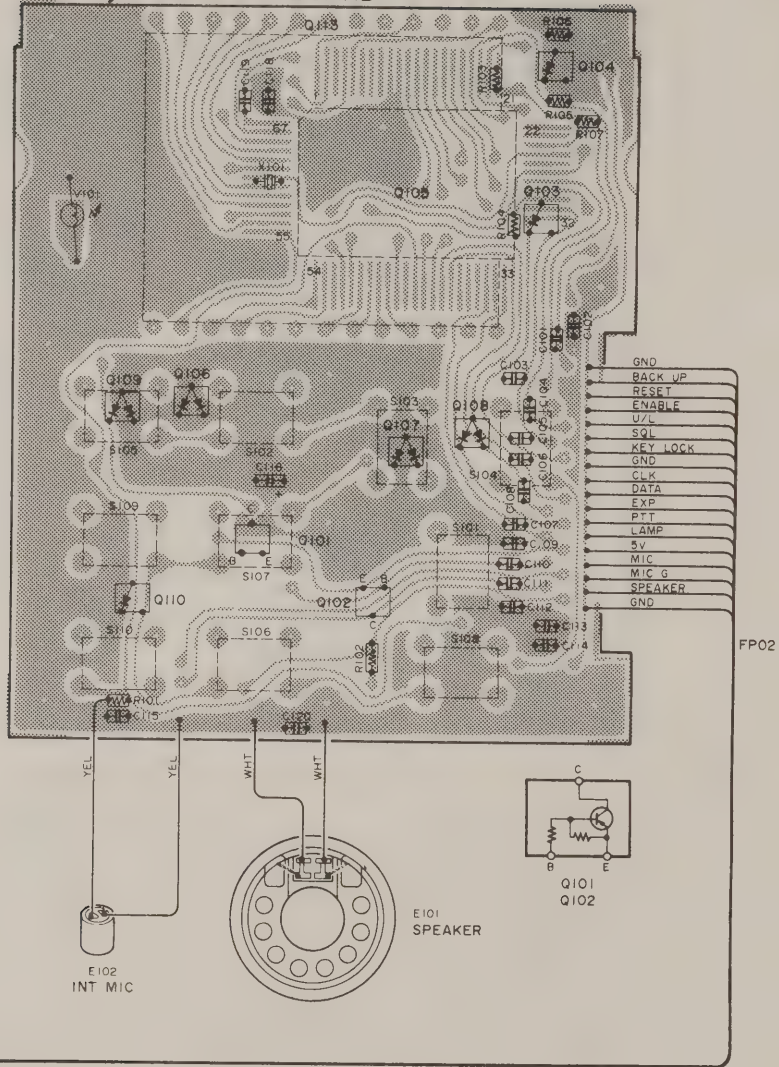
The P.C. Board Layout on Figure 9, page 23 of the HX220S Service Manual is to be replaced by the following drawings. The component side and solder side of each board are shown back-to-back in one page.

PM01 μ -COM P.W. BOARD



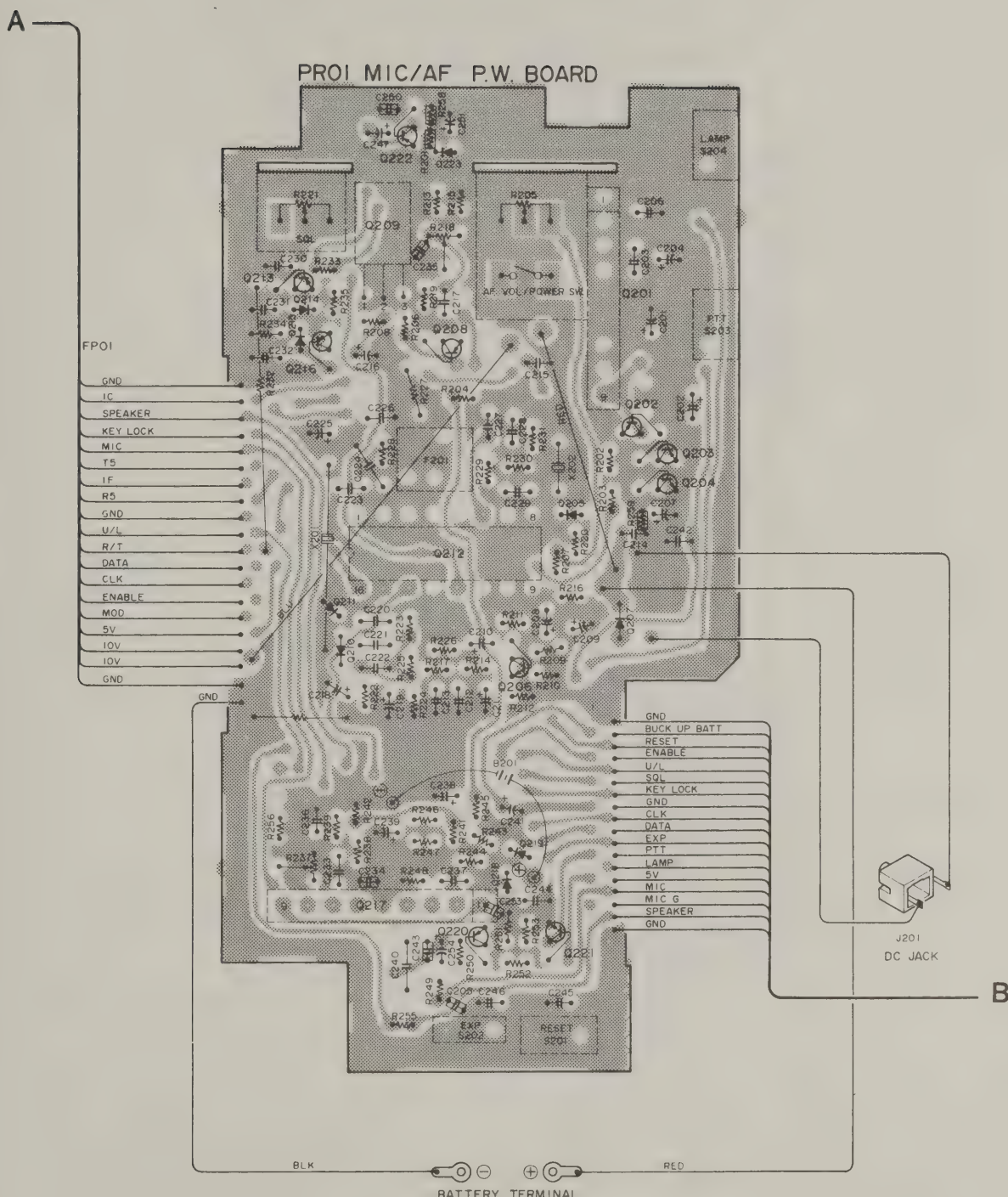
PM01 μ -COM P.W. BOARD

PM01 μ -COM P.W. BOARD



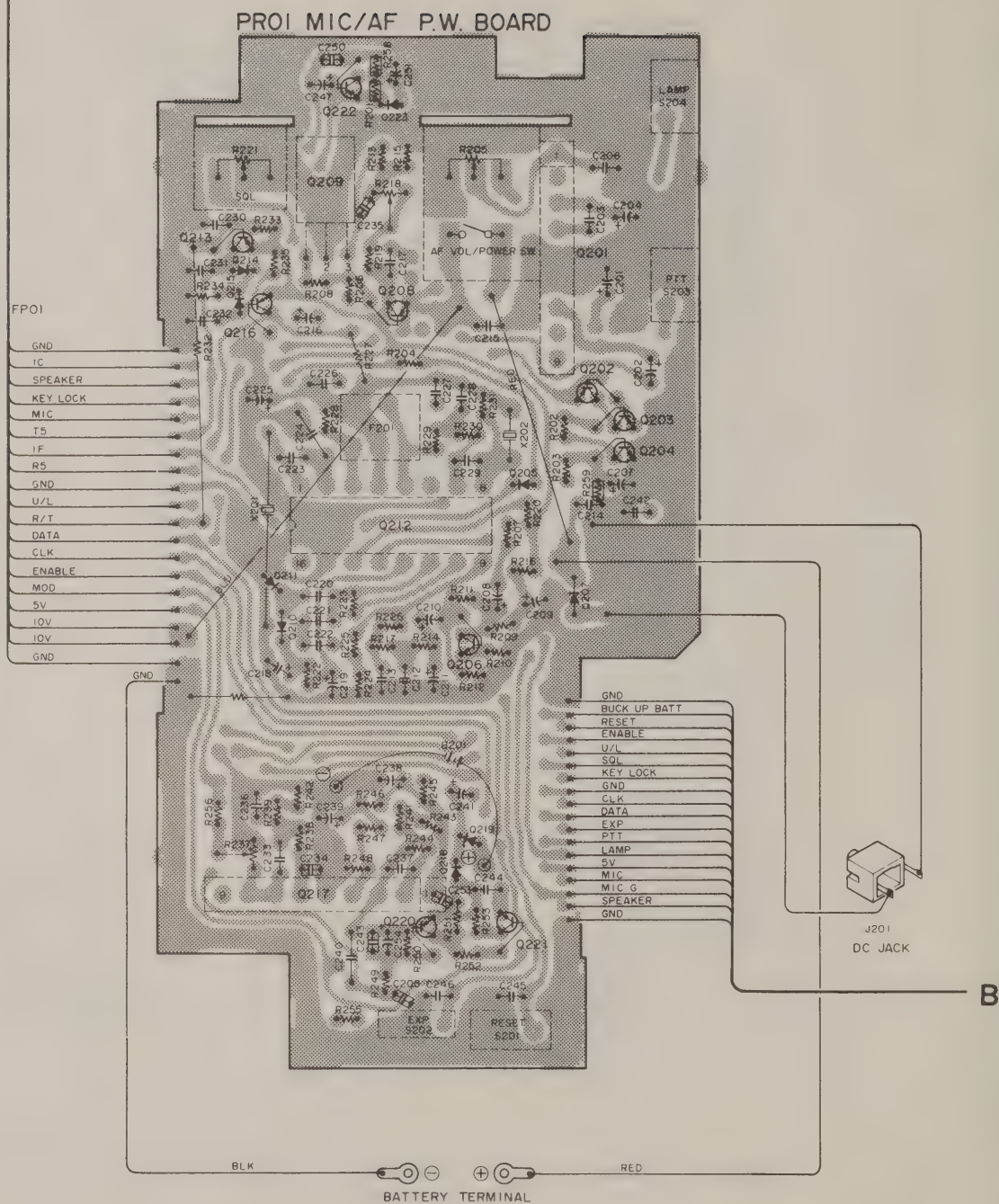
COMPONENT SIDE

PM01 μ -COM P.W. BOARD



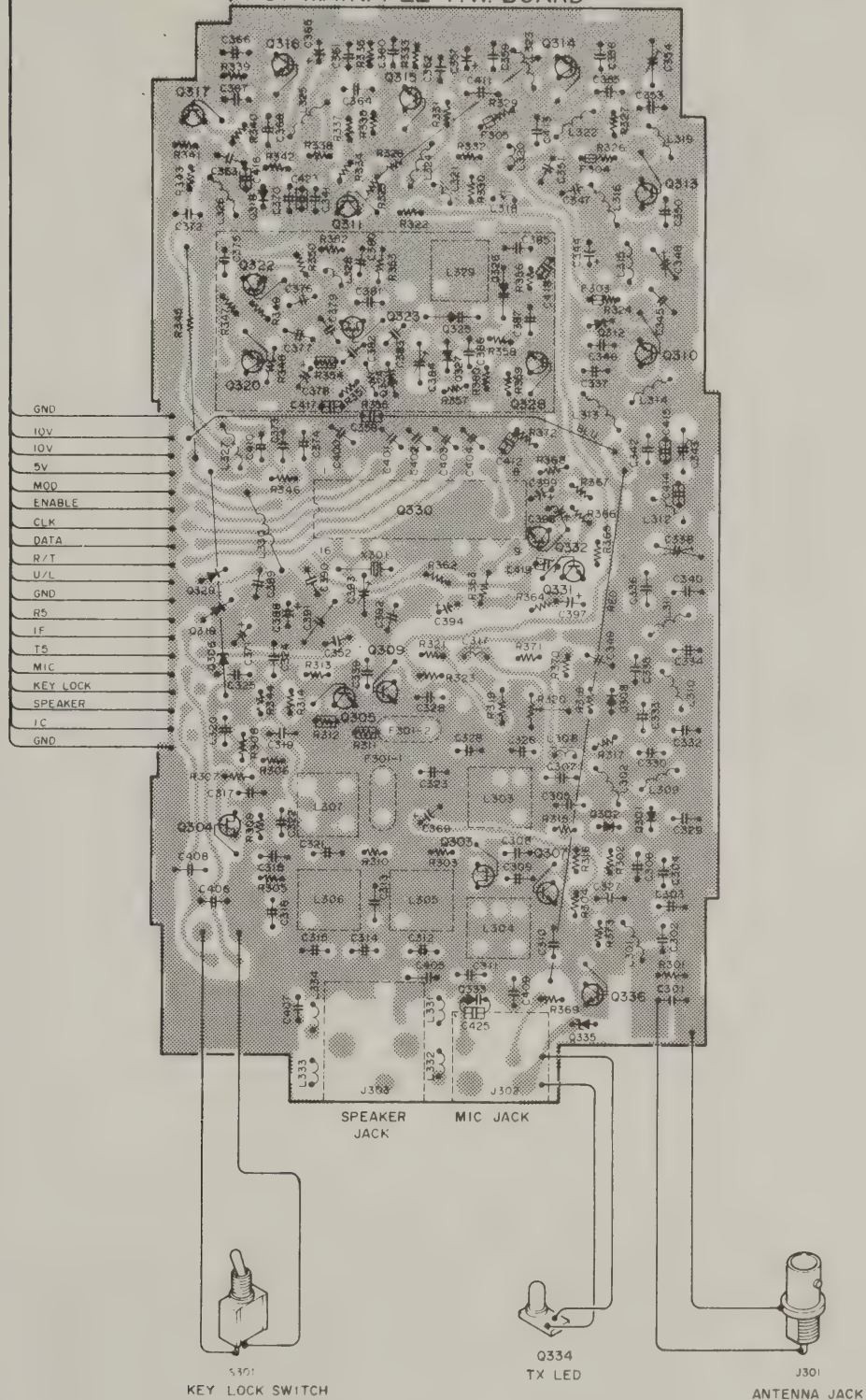
SOLDER SIDE
PRO1 MIC/AF P.W. BOARD

A



B

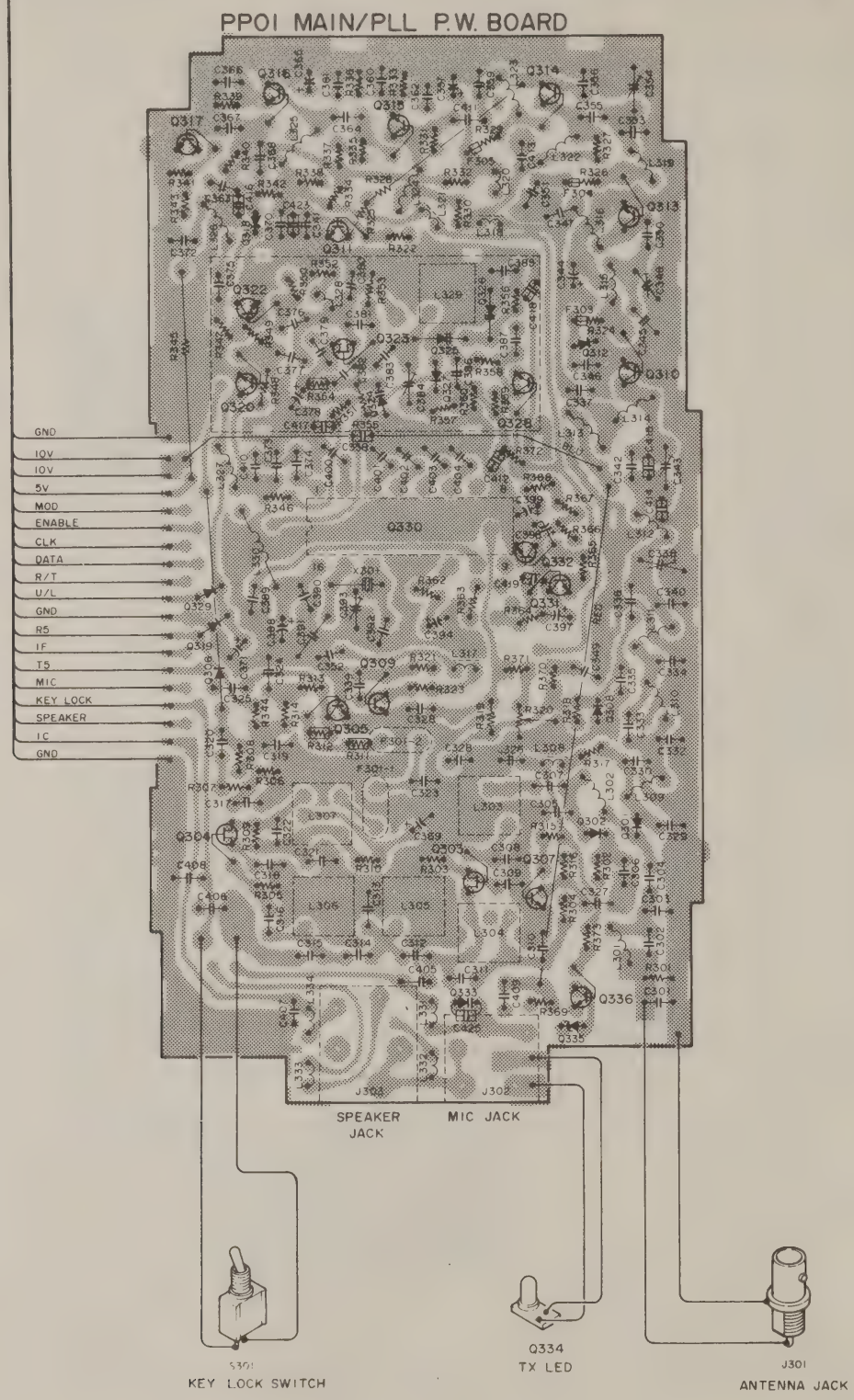
PPO1 MAIN/PLL P.W. BOARD



SOLDER SIDE

PPO1 MAIN/PLL P.W. BOARD

A



COMPONENT SIDE
PPO1 MAIN/PLL P.W. BOARD

HX220S

Horizon/Hand-Phone 6

VHF/FM Handheld Transceiver

This manual is intended for use by qualified technicians and includes all necessary information pertaining to the HX220S operation, installation, circuit design and maintenance. Changes which occur after the printed date will be incorporated in supplemental service publications.

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Table of Contents

Section	Page	Figures
1 SPECIFICATIONS	1	1. Controls Location 6
1.1 General	1	2. Expansion Switch Location 7
1.2 Receiver	1	3. RX Test Setup 12
1.3 Transmitter	1	4. TX Test Setup 13
2 GENERAL INFORMATION	3	5. Alignment Reference Points 15
2.1 Introduction	3	6. PLL Block Diagram 17
2.2 FCC Information	3	7. Transceiver Block Diagram 19
2.3 Power Source	3	8. Schematic Diagram 21
3 OPERATION	5	9. P.C. Board Layout 23
3.1 Basic Operation	5	10. Exploded Parts View 24
3.2 Modification for Canada Operation ..	5	11. U-COM Power Board 25
3.3 Expansion Channels	5	12. MIC/AF Power Board 26
4 THEORY OF OPERATION	9	13. Main/PLL Board 26
4.1 Phase-Locked Loop	9	
4.2 Receiver	9	Charts
4.3 Transmitter	10	1. USA VHF Marine Channel Chart 37
4.4 Microphone Amplifier	10	2. International VHF Marine Channel Chart . 39
4.5 Power Supply	10	3. Canada VHF Marine Channel Chart 41
4.6 Microcomputer Circuit	10	4. Expansion Channel Selection Chart 43
5 MAINTENANCE	11	
5.1 General	11	
5.2 Test Equipment	11	
5.3 Performance Test	11	
5.4 Alignment	15	
6 DRAWINGS	17	
7 PARTS LIST	27	

SPECIFICATIONS

1

Performance specifications are nominal, unless otherwise indicated, and are subject to change without notice.

1.1 GENERAL

Frequency Range 156.025 to 163.275 MHz
Number of Channels 55 Regular; 10 Weather;
15 Reserve

Input Voltage 10 VDC
Current Drain (Standby) 50 mA
(Receive) 250 mA
(Transmit) 1.6 Amp (High)
0.7 Amp (Low)

Channel Spacing 25 kHz
Dimensions 161 mm-H x 60 mm-W x
34 mm-D

Weight 0.6 Kg (1.32 lb.)
Color Brown
Compliance FCC Part 80
FCC Type Acceptance Number APV9T20486
DOC Type Approval Number Pending

BATTERY LIFE

CNB6 (5% TX, 5% RX, 90% Standby):

4 hrs. 50 min. Low
3 hrs. 15 min. High

(10% TX, 10% RX, 80% Standby)

3 hrs. 20 min. Low
2 hrs. 00 min. High

CNB7 (5% TX, 5% RX, 90% Standby)

8 hrs. 10 min. Low
5 hrs. 30 min. High

(10% TX, 10% RX, 80% Standby)

5 hrs. 30 min. Low
3 hrs. 20 min. High

1.2 RECEIVER

(Measurements are made in accordance with
EIA Standard RS-316-A).

Sensitivity:

(12 dB SINAD) 0.30 μ V max.

(20 dB Quieting) 0.35 μ V max.

Squelch Sensitivity

(Threshold) 0.15 μ V max.

Modulation Acceptance

Bandwidth \pm 7.5 kHz

Selectivity 65 dB

Spurious and Image Rejection 60 dB min.

Intermodulation Rejection 60 dB min.

Audio Power Output

at 5% Distortion 0.8 W min.

Frequency Stability (-30 to +60 C) ... \pm 0.0005%

Channel Spread 7.5 MHz

1.3 TRANSMITTER

(Measurements are made in accordance with
EIA Standard RS-316-A)

RF Power Output 6 Watts (High)
1 Watt (Low)

Spurious and Harmonic Emissions 60 dB (Hi)
45 dB (Lo)

Modulation 16K0G3E

Audio Distortion 5%

Frequency Stability (-30 to +60 C) ... \pm 0.0005%

Channel Spread 2.5 MHz

GENERAL INFORMATION

2

2.1 INTRODUCTION

The Standard Communications Corp. (SCC) HX220S Horizon/Hand-Phone 6, VHF/FM handheld transceiver is designed for simplex/duplex marine application. It is capable of operating in 55 marine channels, 10 weather channels, and 15 reserve channels. The transceiver is microprocessor-controlled, incorporates a programmable scanning capability, and its frequencies are controlled by a phase-lock loop (PLL) frequency synthesizer.

The HX220S generates PLL-controlled frequencies in the 155 to 163 MHz frequency ranges. A temperature-compensating circuit in the HX220S maintains stable frequencies over varying temperatures.

The HX220S has an RF power output of 6 watts in the high range and 1 watt in the low power range. During transmission, the TX indicator light illuminates.

The HX220S squelch control is designed to eliminate the static present when no signal is being received. The scan feature allows frequencies which have been programmed into the radio by SCC to be scanned until a busy channel is found or the CLR button is pressed. Channels to be scanned are marked by pressing the SCAN key when the channel number is being displayed.

2.2 FCC INFORMATION

The HX220S complies with the Federal Communications Commission (FCC) requirements that regulate Maritime Radio Service. The user must know and comply with all applicable parts of FCC Rules and Regulations. Rules applicable to each service may be ordered from:

SUPERINTENDENT OF DOCUMENTS
Government Printing Office
Washington, D.C. 20402

A valid station license and call sign issued by FCC is required before operating the HX220S. It is the user's responsibility to file FCC Form 506 and Form 753 to operate a transceiver. Form 506 is a ship station license to install a transceiver on the ship. Form 753 is a restricted radio operator's license.

The following data pertaining to the HX220S will need to be included on the FCC license application.

Type Accepted FCC Part 80
Output Power 1 watt and 6 watts
Emission 16K0G3E
Frequency Range 156.025 to 163.275 MHz
FCC Type Number APV9T20486

The FCC requires that a copy of Part 80 be kept aboard the ship at all times. The FCC application contains an order form for these regulations.

The onboard transceiver must be manned by a licensed radio operator. Others may speak into the microphone if the operator starts the transmission, identifies the transmission, supervises it, ends it, and logs it.

The operator is at all times responsible for the lawful operation of the station. Distress and safety communications must have absolute priority over other kinds of ship-to-ship and ship-to-shore calls.

2.3 POWER SOURCE

The HX220S is equipped with the CNB6 battery pack, which is the recommended power source for the handheld. The CNB6 consists of eight individual nickel-cadmium (ni-cad) batteries encased in the bottom of the handheld. It supplies the 10 VDC required for proper handheld operation.

To remove the CNB6, depress the battery lock button while twisting the battery pack off in a counterclockwise direction. Do not use excessive force. To replace the battery pack, twist it back on in a clockwise direction.

The CNB7 is an optional heavy-duty battery pack which may be used in place of the CNB6. Refer to the Specifications section of this manual for a comparison of their duty life.

The HX220S is supplied with the CWC25 plug-in wall charger which will charge the CNB6 battery pack in 10 to 12 hours, and the CNB7 battery pack in 16 to 19 hours.

CAUTION: Do not charge either battery pack for periods longer than those specified or they will be irreparably damaged.

Before using your CWC25 charger in standard U.S. outlets, confirm that its power setting switch is set at 120 V. In Europe and other foreign lands, set the switch at 230 V and use the supplied wall adaptor plug.

To prevent the possibility of a short, plug the CWC25 into the charger terminal of your transceiver before plugging its power receptacle into the wall outlet and make sure the charger terminal is completely plugged into your transceiver. The charger terminal is located on the push-to-talk switch side of the HX220S.

When using the optional CSA20 drop-in rapid charger, the contacts at the bottom of the CNB6 and CNB7 battery packs allow the battery packs to be charged when connected or disconnected from the transceiver. The CSA20 will rapid charge the CNB6 in 50 minutes, the CNB7 in 80 minutes. Do not over-charge.

OPERATION

3

3.1 BASIC OPERATION

See Figure 1 for the controls location.

1. Rotate the squelch control counterclockwise.
2. Turn on the ON/OFF volume control. Adjust the volume level.
3. Rotate squelch control clockwise until background noise disappears.
4. To select channel, press the UP or DOWN key. The selected channel will be illuminated on the digital display.
5. Press the CH16 key to go to channel 16 from any channel. Press CLR key to revert to the working channel.
6. Press the WX key for quick access of WX01 weather channel. To select other weather channels, press the UP or DOWN key. Press the CLR key to revert to the working channel.
7. If expansion channels are programmed, press the EXP key for quick access of EXP01 channel. Press UP or DOWN key to go to another programmed expansion channel. Press the CLR key to revert to the working channel.
8. Transmission is accomplished as follows:
 - a. Set the H/L power switch to "L" when in harbor or whenever it provides sufficient output power.
 - b. Select and monitor the desired channel. It is illegal to transmit on a channel without first monitoring it.
 - c. Depress the push-to-talk (PTT) switch and deliver the voice message. The TX indicator will illuminate.
 - d. Release the PTT to receive incoming messages.
9. Scan is accomplished as follows:
 - a. Press the R/D key to set channel for scanning. When pressed once, "MEM" is displayed indicating that the channel has been stored in the memory.
 - b. Press the SCAN key to scan the channels that have been stored in the memory. Scanning is only possible when two or more channels have been stored in the memory.
 - c. Observe the digital display for channels being scanned.
 - d. To stop scanning, press CLR (clear) key.
 - e. To resume scanning, press the SCAN key.
 - f. To delete a selected scan channel, press the R/D key again. The "MEM" on the display will disappear indicating that the scan channel has been deleted from the memory.
 - g. Slide the KEY LOCK switch to the ON position to lock all keys except the H/L key.
10. Press the U/I key to change the mode of operation from International to USA (Canada) or from USA (Canada) to International. The display will show "I" for International, "U" for USA, and "C" for Canada.

3.2 MODIFICATION FOR CANADA OPERATION

For operation in Canada frequencies, install a 1SS187 diode (SCC Part Number HZ20006050) in the PM01 P.C. Board at the location of Q111.

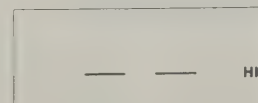
If diode is installed, the transceiver will operate in the Canada and International modes only. The display will indicate "C" for Canada operation.

3.3 EXPANSION CHANNELS

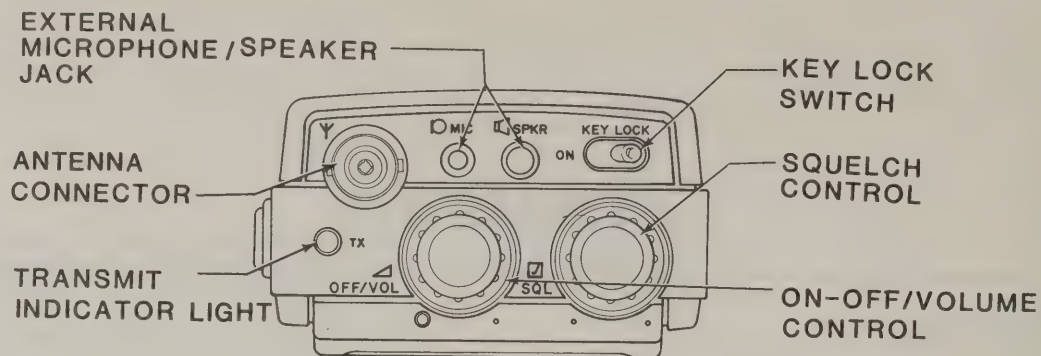
3.3.1 Programming Expansion Channels

To program expansion channels, perform the following procedure.

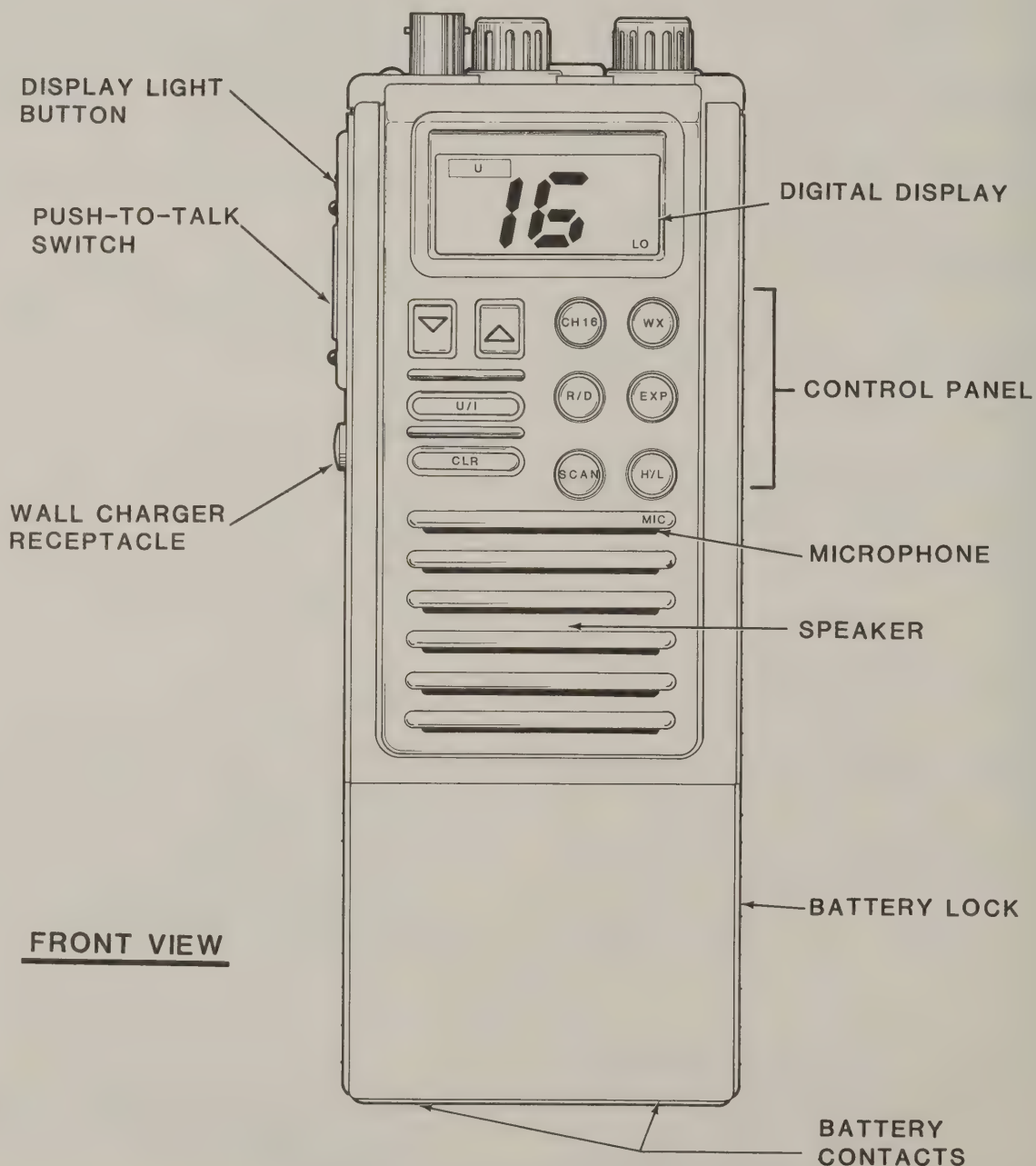
1. Turn on the expansion switch at the bottom of the transceiver (see Figure 2 for the location). The display should show the following:



2. Press the CH16 key and keep it depressed. The display should show the expansion channels address:



TOP VIEW



FRONT VIEW

FIGURE 1. CONTROLS LOCATION

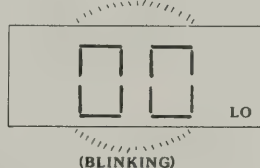


3. Release the CH16 key. The display should revert to the one shown in step 1.
4. Select an expansion channel from the Expansion Channel Selection Chart.
5. Press the UP or DOWN key until the selected channel number is shown blinking on the display.

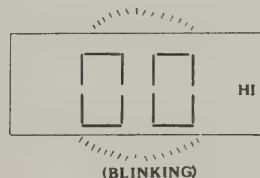


6. To select the power for the programmed channel, press the H/L key until the display shows the following.

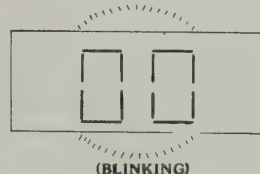
For low power:



For high power:

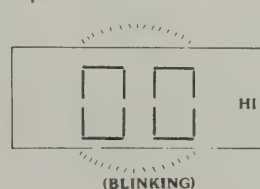


For TX INH:

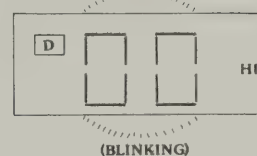


7. To select either simplex or duplex operation, press the SCAN key until the display shows the following.

For simplex operation:



For duplex operation:



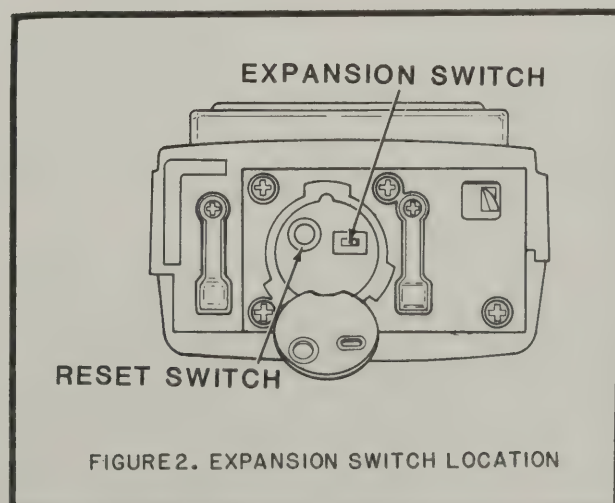
8. Press the R/D key to store the desired channel and the selected conditions on the expansion address 01. The display should stop blinking.



9. To program another channel, press the EXP key. The display should revert to the one shown in step 1. Press the EXP key again. The display should show the next expansion address.



10. Perform steps 4 to 8 for the next channel to be programmed.
11. To check the expansion address of the channel being programmed, press the EXP key while keeping the CH16 key depressed.
12. To delete a programmed channel from the memory, press the CLR key.
13. After all desired expansion channels are programmed, remove the battery from the transceiver and slide the EXP switch to the OFF position. Replace the battery. The expansion channels are now ready for operation.



3.3.2 Operation of Expansion Channels

1. If expansion channels are programmed in the transceiver, press the EXP key to display expansion address from 01 through 15 depending on the number of expansion channels programmed.
 2. Press the UP or DOWN key to move to the expansion address of the next programmed channel.
 3. Press the EXP key to revert to EXP01 from any other channel.
 4. To activate busy scanning of expansion channels, press the EXP key for more than 0.4 second. The expansion address number increases at a rate of 6 channels per second.
 5. To stop scanning, press CLR key.
 6. To revert to the working channel, press the CLR key again, then press the EXP key.
-

THEORY OF OPERATION

4

Refer to the block and schematic diagrams for the following section.

4.1 PHASE-LOCKED LOOP (PLL)

4.1.1 PLL

The output of the VCO, Q323 is passed through the Q320 where the signal is buffered and amplified. The signal goes to pin 1 of Q330 and is applied to one of the inputs of the phase detector in the PLL IC. The signal is then divided by an N number which is programmed in the programmable divider.

The output of the 12.8 MHz reference oscillator is applied to pins 14 and 15 of Q330. This signal is divided to 6.25 kHz by another internal counter and fed to the input of the phase detector in the PLL IC.

The two signals entering the phase detector are compared. The phase detector outputs an error signal from pin 9 which is filtered in the lowpass filter Q331 and Q323 and applied to the varicap diodes Q325 and Q326 to correct the VCO frequency.

Two bits sent to the programmable divider from the microcomputer are directly output to pins 6 and 7 of Q330. The bit output on pin 6 controls the transceiver's PTT function. When the bit is low, the transceiver is in the transmit mode. The bit output on pin 7 controls the high/low power condition. When the bit is low, the transceiver is in the high power mode.

4.1.2 VCO

The modulation from the IDC (R237) is fed to the varactor diode Q324 which modulates the VCO.

Q327 and Q328 are controlled by the "TX voltage (5V)" switch. During receive mode, Q327 is turned on and Q328 is turned off and C384 decreases the VCO frequency.

4.2 RECEIVER

The receiver uses a double-conversion superheterodyne system with a 1st IF of 21.4 MHz and a 2nd IF of 455 kHz.

4.2.1 RF Amplifier

The incoming RF signal from the antenna is passed through the antenna lowpass filter, the antenna switch circuit, and then applied to L303. The signal is amplified in Q303 and passed through the bandpass filters L304 through L306 and applied to the gate of the 1st mixer, Q304.

4.2.2 1st Mixer

The 1st mixer, Q304 mixes the PLL local signal (128.6 to 141.875 MHz) which is applied to its source, and the RF signal. The output from the drain of the 1st mixer is the 1st IF signal. The signal passes through L307 and goes to the 21.4 MHz crystal filter F301 and F302 to obtain superior cross-modulation characteristics.

4.2.3 IF Amplifier

The filtered signal (21.4 MHz) is amplified by the 1st IF amplifier Q305. The signal is applied to IC Q212. The functions of Q212 are oscillation of 2nd local signal with X201, mixing of 2nd local signal and the 1st IF signal, limiting amplification of 2nd IF signal, and detection of quadrature circuit.

The 2nd IF signal is the output from pin 3 of Q212. The signal is passed through the ceramic filter F201 to reject adjacent spurious signals. The signal is then applied to pin 5 of Q212 and goes out of pin 9 as an audio signal.

4.2.4 Audio Amplifier

The audio signal is passed through the de-emphasis circuit comprised of R217, C212, R214 and C211 then amplified by pre-amplifier Q206. The output of Q206 is passed to the AF volume control R205 and amplified by the audio power amplifier Q201 to drive the speaker E101.

4.2.5 Squelch Circuit

The audio signal from pin 9 of Q212 is applied to an active highpass filter comprised of Q212, R225, R226, C221, C222 and R224 to remove any audio signal and leaving the noise signal. The

noise is detected by Q210 and Q211 and made smooth by R222, C218, and C219. Then the DC voltage passes through the squelch volume switch R221 and goes to pin 12 of Q212. The voltage on pin 12 of Q212 turns the squelch on or off as follows:

Q212		Q204	
pin 12	pin 13	Squelch	
◀ 0.7 V	LOW	OFF	ON
▶ 0.7 V	HIGH	ON	OFF

4.3 TRANSMITTER

The signal from the PLL circuit is amplified by the exciter stage Q313 through Q316 and passed through the final amplifier Q310. There are two lowpass filters, before and after the antenna switch circuit, to eliminate the spurious signals.

The first stage of the lowpass filter, passes part of the signal which is detected by diode Q308 and applied to Q309 and Q311 to obtain a constant output by controlling the emitter current of Q314.

Q317 stops the emission of undesired radio waves during the receive and unlock mode, setting the bias line of power stage Q310, Q313 through Q316 for GND level.

4.4 MICROPHONE AMPLIFIER

The audio signal from the built-in or external microphone is applied to the MIC amplifier Q217.

By connecting a 22 kohm resistor between the external MIC line and GND, Q220 and Q221 are turned on and the signal is applied to the microcomputer to provide transmit mode. The input audio signal is amplified by 1/2-Q217 and passed through the lowpass filter (the other 1/2-Q217). The signal is passed to the pot volume R237 for deviation setting and applied to the modulation circuit of the VCO.

4.5 POWER SUPPLY

The regulator consists of IC Q208 and Q209 which set the voltage 5.1 V by adjusting the pot volume R218. Q222 acts as the protection circuit.

4.6 MICROCOMPUTER CIRCUIT

The transceiver is controlled by the the microcomputer Q105.

The clock operation of the microcomputer is controlled by the ceramic oscillator X101 which has frequency of 1 MHz. the initial setting of the microcomputer is determined by the matrix diodes Q106 to Q112. The switches S101 to S110 establish frequencies and other conditions.

MAINTENANCE

5

5.1 GENERAL

The inherent quality of the solid-state components used in this transceiver will provide many years of continuous use. Taking the following precautions will prevent damage to the transceiver.

1. Never key the transmitter unless an antenna or suitable dummy load is connected to the antenna receptacle.
2. Ensure that the input voltage does not exceed 11.5 VDC or fall below 8.5 VDC.

5.2 TEST EQUIPMENT

To perform the alignment and test procedures in this section, a technician will require the following, or equivalent, test equipment:

Cushman CE-6A	FM Communications Monitor
Bird 6154	RF Wattmeter with 50-ohm Load
Cushman CE-11	Tone Generator
Hewlett Packard 427A	Voltmeter
Hewlett Packard 11096B	RF Probe
Hewlett Packard 5314A	Frequency Counter
Hewlett Packard 1220A	Oscilloscope
Adjustable, 8V to 13V, 2A ..	Power Supply
Helper Instruments	Sinadler

The following optional equipment may also be used:

Hewlett Packard 8558B with display	RF Spectrum Analyzer
Danometer 2000	Digital Voltmeter
Wavetech 3000	Signal Generator

5.3 PERFORMANCE TEST

5.3.1 GENERAL

1. Set the internal modulation on the FM RF signal generator for a frequency of 1 kHz and a deviation of ± 3 kHz.
2. Set the power supply for 10 VDC.

5.3.2 RECEIVER

Connect the test equipment as illustrated in Figure 3.

Sensitivity (20 dB Quieting)

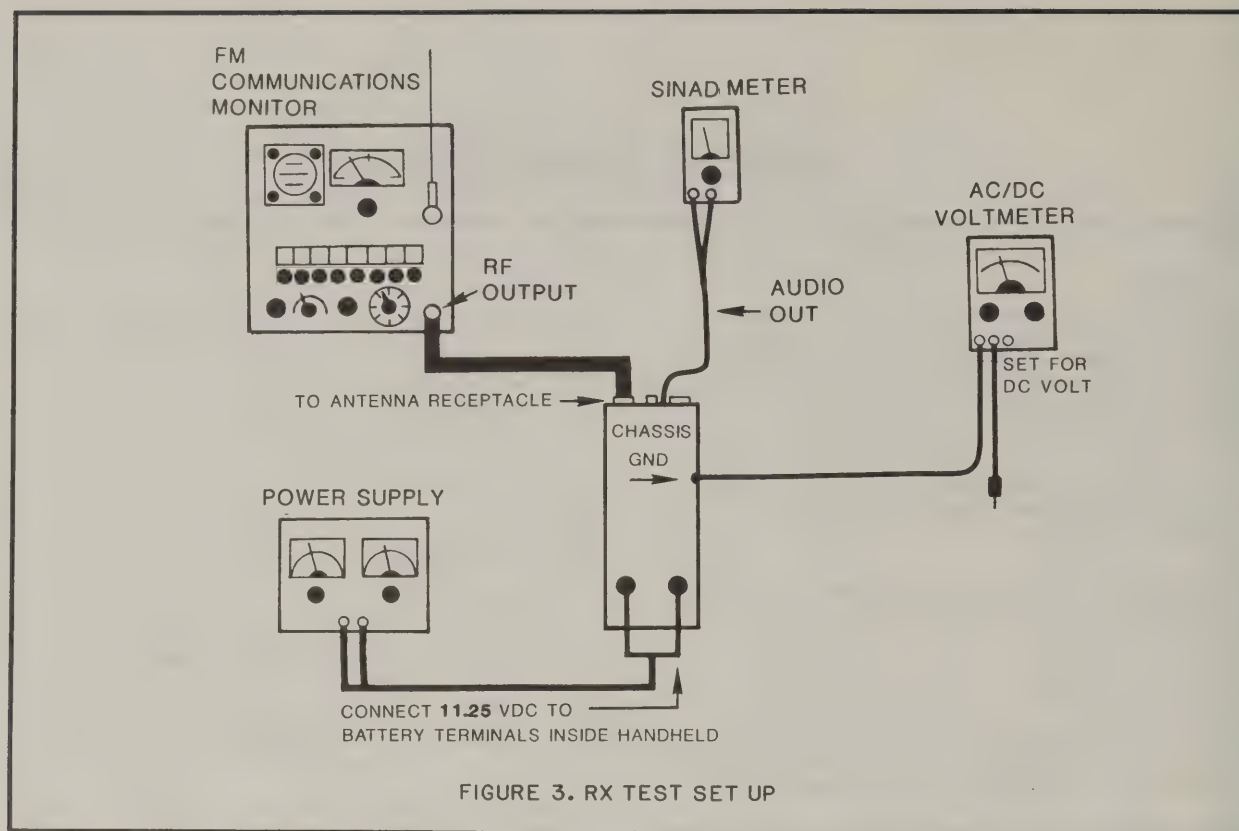
1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: off
 - output level: minimum
2. Set the squelch control to minimum.
3. Set the volume control for 0 dB, approximately 0.8 VAC on the AC voltmeter.
4. Increase the signal generator RF output level until the AC voltmeter drops 20 dB, approximately 0.08 VAC on the AC voltmeter.
5. Confirm that the signal generator RF output level does not exceed 0.5 μ V.

Sensitivity (12dB SINAD)

1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: 1 kHz tone \pm 3 kHz deviation
 - output level: minimum
2. Set the squelch control to minimum.
3. Set the volume control for approximately 50% of full output power reading on the AC voltmeter.
4. Increase the signal generator RF output level until the SINAD meter reads 12 dB.
5. Confirm that the signal generator RF output level does not exceed 0.35 μ V.

Threshold Squelch

1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: 1 kHz tone \pm 3 kHz deviation
 - output level: minimum
2. Set the squelch control to minimum, slowly increasing it until the transceiver squelches.
3. Slowly increase the signal generator RF output level until the transceiver unsquelches.
4. Confirm that the signal generator RF output level does not exceed 0.25 μ V.



Tight Squelch

1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: 1 kHz tone \pm 3 kHz deviation
 - output level: minimum
2. Set the squelch control to maximum.
3. Slowly increase the signal generator RF output level until the transceiver unsquelches.
4. Confirm that the signal generator RF output level is not less than 20 dB quieting sensitivity, and that the level is not more than 15 dB above the 20 dB quieting sensitivity.

Audio Power

1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: 1 kHz tone \pm 3 kHz deviation
 - output level: 1000 μ V
2. Slowly turn the volume control to maximum while watching the oscilloscope for any oscillation or break-up.
3. With no sign of oscillation or break-up, confirm that the AC voltmeter does not read less than 2.5 volts.

Discriminator

1. Set the RF signal generator as follows:
 - frequency: transceiver frequency
 - modulation: 1 kHz tone \pm 5 kHz deviation
 - output level: at 12 dB SINAD (approximately 0.3 μ V)
2. Adjust the RF signal generator frequency for maximum SINAD.
3. Confirm that RF signal generator frequency does not deviate more than \pm 1.5 kHz from the assigned frequency.

5.3.3 TRANSMITTER

Connect the test equipment as illustrated in Figure 4.

Power Output

1. Depress the push-to-talk (PTT) switch.
2. Confirm that the RF power meter does not read less than 6.0 watts.
3. If the unit incorporates a high-low power switch, confirm that the reading at the low power position is no less than 0.5 watt and no more than 1.0 watt.

Modulation

1. Depress the PTT switch.
2. Apply enough modulation to obtain full limiting.
3. Confirm that deviation is between ± 4 kHz and ± 5 kHz.

Frequency

1. Depress the PTT switch.
2. Confirm that the frequency reading is within ± 750 Hz of the assigned frequency.

Spurious Emissions

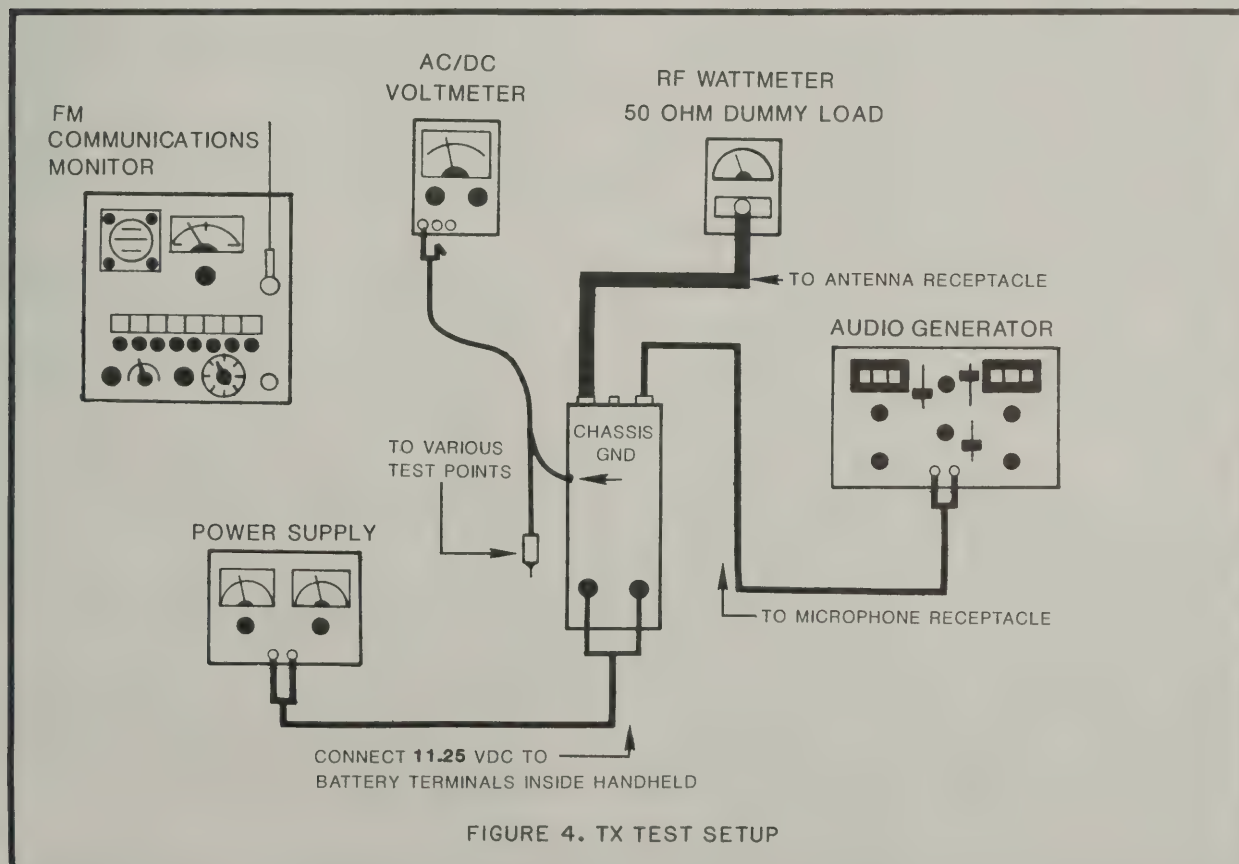
1. Depress the PTT switch.
2. Set the power switch to HI. Confirm that spurious emissions are more than 60 dB below the transmitter carrier.
3. If the unit incorporates a high-low power switch, set the power switch to LO. Use a

spectrum analyzer to confirm that the reading at the low power setting is more than 45 dB below the transmitter carrier.

Reset Switch

1. Depress and hold the square button on the right side of the transceiver. Turn the lower portion (battery pack) of the transceiver counterclockwise until it stops. Remove the battery pack from the transceiver and release the square button.
2. Turn the transceiver upside down and lift the circular plastic RESET/EXP tab recessed inside the hole in the metal surface.
3. Press the black button that was covered by the RESET/EXP tab. Press the tab back into place.
4. Reattach the battery pack by inserting the keyed knob into the notched hole at the bottom of the transceiver. Turn the battery pack clockwise until it locks in position.

An alternate method in resetting the microprocessor is to do the following



procedure.

1. Turn off the ON/OFF volume control.
2. Press and hold the CLR button.
3. Turn on the ON/OFF volume control.
4. Release the CLR button. The transceiver should now be reset.

5.3.4 NORMAL NON-SCAN OPERATION

1. Apply power to the transceiver by turning the OFF/VOL knob clockwise until static is emitted through the speaker. Adjust the squelch control clockwise until the static disappears.
2. Confirm that a channel number appears on the display and a "U" indicating USA mode appears in the upper left corner of the display.
3. Press the CH16 button. Confirm that the display shows "16". Pressing the CH16 unlocks the mode so that it can be changed.
4. Press the U/I button to change the mode. Verify that the "U" in the upper left corner of the display changes to an "I", indicating that the transceiver is in the international mode.
5. Press the CH16 key to unlock the mode.
6. Press the U/I button. Confirm that the display shows a "U" in the upper left corner indicating that the transceiver is back in the USA mode.
7. Enter a USA marine channel from the chart by pressing the UP/Down keys on the control panel until the desired channel appears on the display.
8. A "Hi" or "Lo" should appear in the upper right-center portion of the display, indicating that the power setting of the transceiver is set at high and low, respectively. Press the H/L key and confirm that the display indicator changes accordingly.
9. Confirm that a "D" appears in the lower-left corner of the display for semiduplex operation and that the "D" disappears for simplex operation. Semiduplex channels have different frequencies for transmit and receive.

10. Press the WX key to change to weather channel number 1. A "D" and "WX" should appear in the lower left-center portion of the display. Press the UP or DOWN key 9 more times to run through the 10 weather channels. As the channels change, watch the display to confirm that the indicators change accordingly.
11. Push the display lamp button located at the left side of the transceiver above the PTT switch. Confirm that the display lamp illuminates.
12. Set the transceiver for operation on any channel. Slide the KEY LOCK switch located directly above the digital display, to the left into the ON position. Press the control buttons on the front panel to confirm that they all buttons except the H/L power switch.
13. Slide the KEY LOCK switch to the right into the OFF position. Confirm that the front panel buttons are functional again.

5.3.5 SCANNING OPERATION

1. Apply power to the transceiver by turning the OFF/VOL knob clockwise until the static is emitted through the speaker. Adjust the squelch control clockwise just until the static disappears.
2. Enter a marine channel number from chart by pressing the UP/DOWN keys on the front panel.
3. Press the R/D key to program the chosen marine channel and to link it to the displayed scan channel designator. The marine channel entered in step 2 should appear in the display with "MEM" displayed in the upper right-center portion of the display.
4. Program a second marine channel from chart in the same manner as described for the first channel.
5. Program a third marine channel from chart in the same manner as described for the first channel.
6. Press the SCAN key. The display should show the channels that have been programmed continuously. Scanning should stop when a busy channel is encountered and resume scanning automatically when the channel is no longer busy.

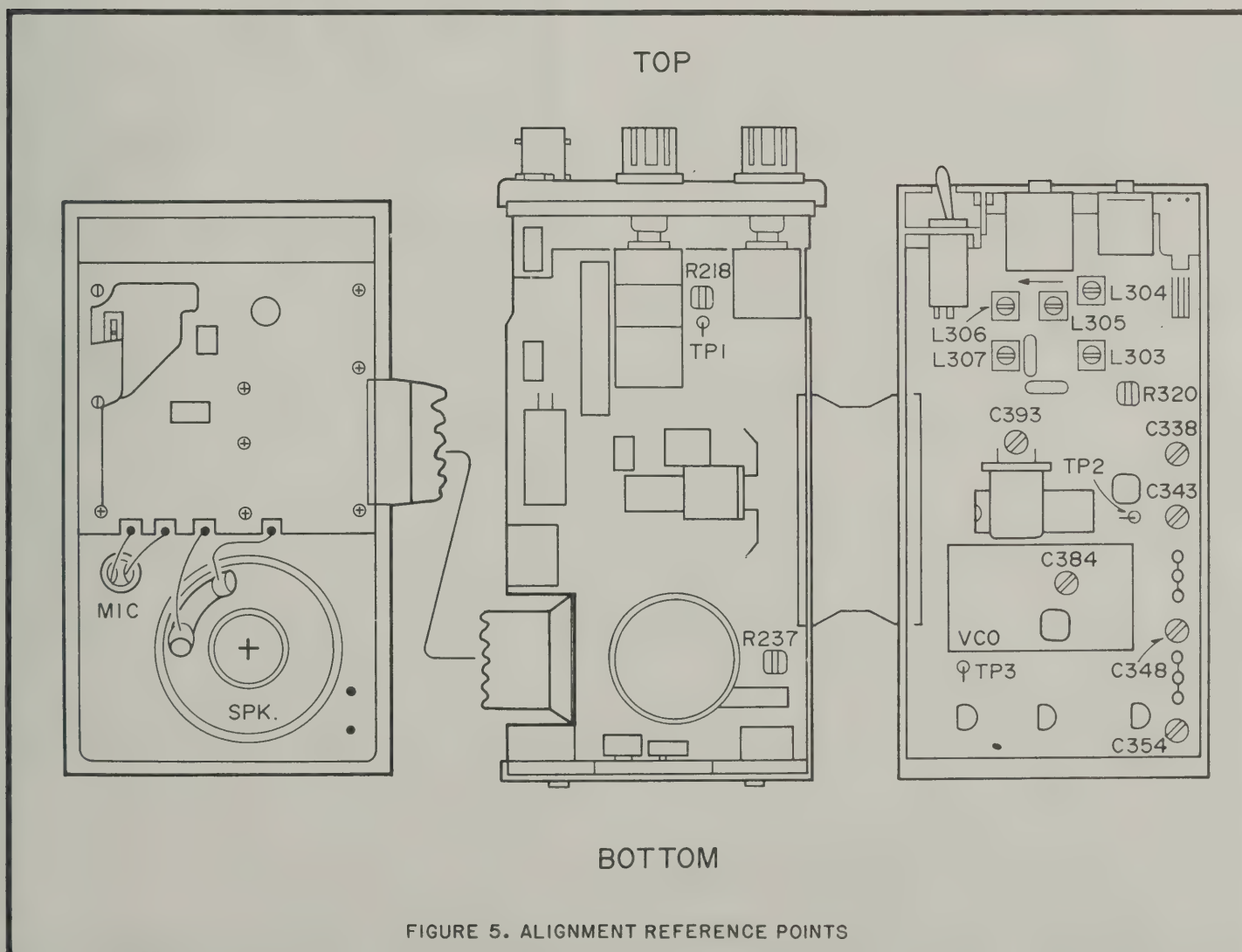
7. Press the CLR button to stop scanning on a scan channel.
8. Enter a marine channel number from the chart by pressing the UP/DOWN key. Keep a record of the channel number entered.
9. Repeat steps 6 and 7.
10. Press the CLR key and confirm that the marine channel that was entered in step 8 is displayed.
11. Press the UP/DOWN key until one of the channels that have been programmed for scanning is displayed.
12. Press the R/D key. Confirm that the "MEM" on the display disappears.

5.4 ALIGNMENT

Refer to Figure 5 for the location of the alignment points.

5.4.1 5V Regulator

1. Connect the "DC 10V" terminal of the power supply to the "DC IN" of the transceiver.
2. Turn on the "POWER/VOLUME" control.
3. Connect a DC voltmeter to TP1. Adjust R218 for a voltmeter reading of 5.1 V. Turning R218 clockwise increases the volume while turning it counterclockwise, decreases the volume.



5.4.2 VCO

1. Set the transceiver in the RX mode and set to WX04 frequency (163.275 MHz).
2. Connect the voltmeter to TP02 and adjust C384 for a reading of 3.5 V.
3. Connect the voltmeter to TP03. Adjust C393 to tune the RX local oscillator frequency as follows :

CH1 - 134.650 MHz CH19 - 135.550 MHz
WX04 - 141.857 MHz

The frequency deviation should be within ± 1.5 kHz.

5.4.3 Receiving RF Coil

1. Set the transceiver to the receive mode.
2. Set the signal generator to the CH19 frequency (156.950 MHz). Connect the output of the signal generator to the antenna connector of the transceiver.
3. Connect a SINAD meter to the external speaker jack.
4. Adjust L307 for a maximum SINAD reading.
5. Adjust L303 through L306 for minimum SINAD reading differences between the marine, WX, and expansion bandwidths.

NOTE: The 12 dB SINAD sensitivity of frequencies 162.550 to 163.275 MHz should be less 0.5 μ V.

5.4.4 Transmitter

1. Connect the power meter to the antenna connector of the transceiver.
2. Set the transmit frequency of the transceiver to the CH16 frequency (156.800 MHz).
3. Apply 10 V to the transceiver from the power supply.
4. Rotate R319 fully clockwise.
5. Key the transmitter.
6. Adjust the trimmer capacitors C338, C343, C348 and C354 for maximum RF power output.
7. Adjust the corresponding coils of the trimmer capacitors.

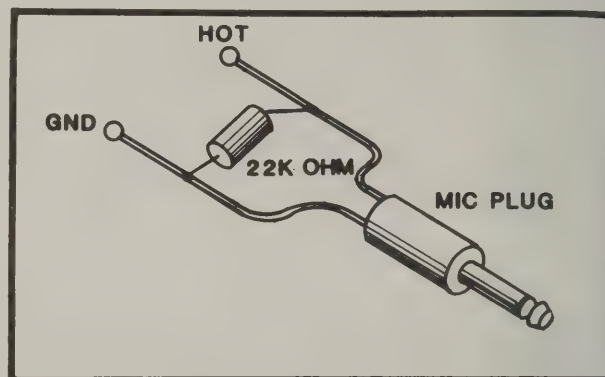
8. Set the H/L power key to high. Adjust R319 to 6 watts.

9. Set the H/L power key to low. Adjust R320 to 0.7 watt.

NOTE: The output power for expansion channel operation should be more than 5 watts.

5.4.5 Deviation

1. Connect the MIC PLUG to the mic input jack. Apply 1 kHz, 60 mV from the audio generator.



2. Adjust R237 for a frequency deviation of ± 4.5 kHz.
3. Adjust the mic input level for a frequency deviation of ± 3.5 kHz. The mic input level should be within 9 to 14 mV. ensure that there is no AC leakage on the ground of the audio generator.

6

6.2 REVISIONS

As drawings are updated, parts changes which are not compatible with all versions of the transceiver are detailed in a revision list printed on the back of the applicable drawing. Organized chronologically by model serial number, each revision list includes: the reference designators of the part, a description of the revision, and the serial number of the first unit that incorporates the change.



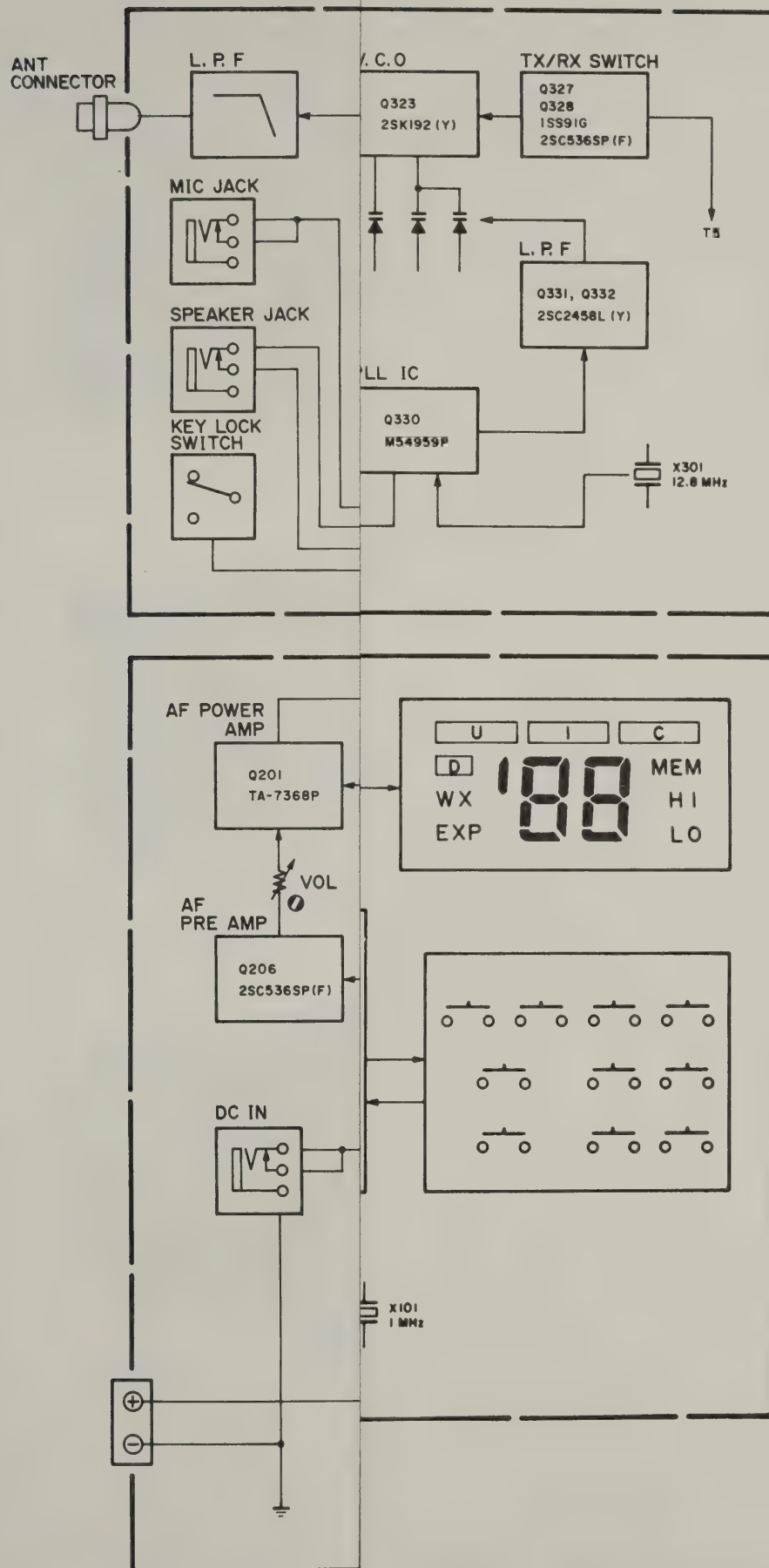


FIGURE 7. TRANSCEIVER BLOCK DIAGRAM

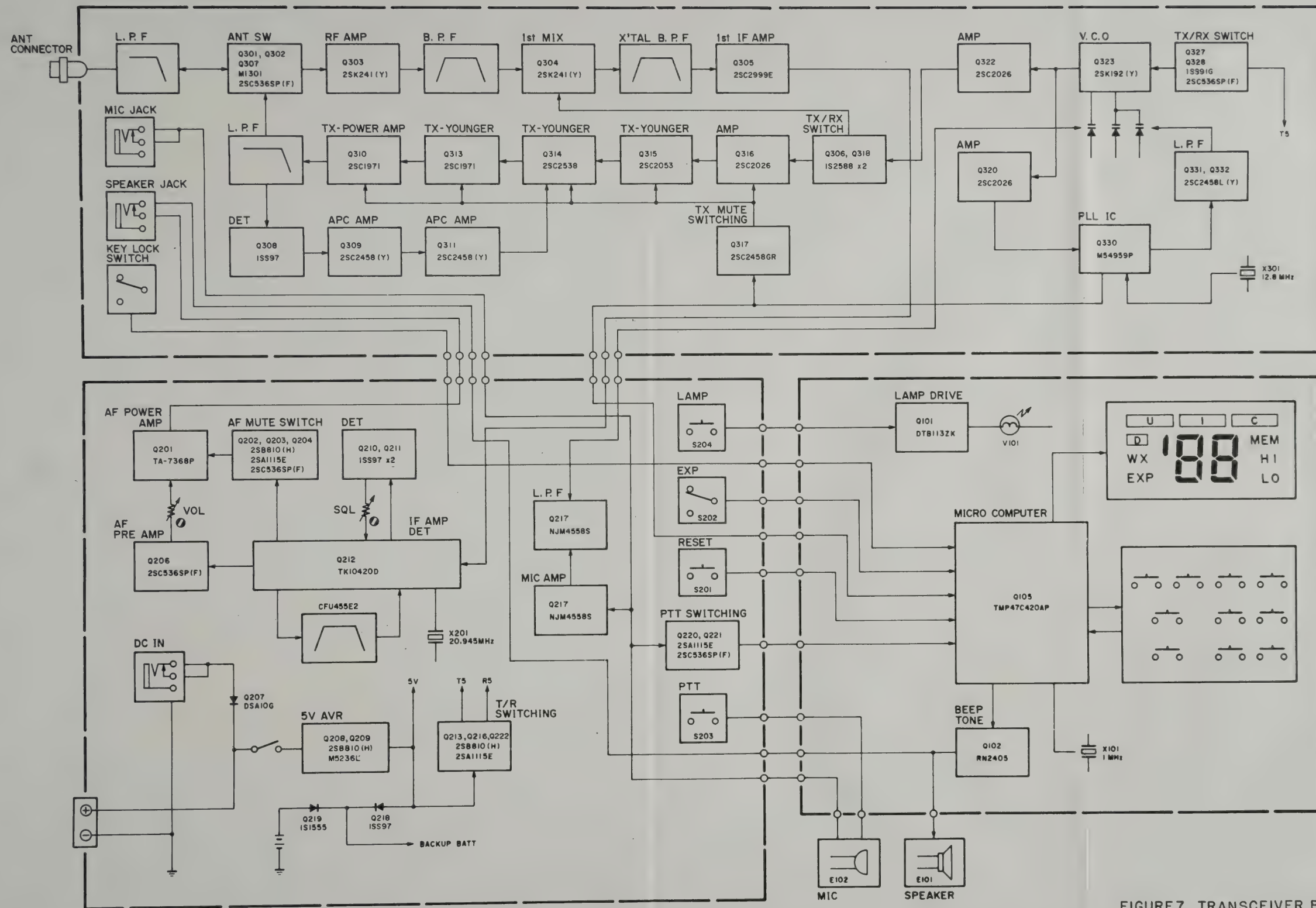


FIGURE 7. TRANSCEIVER BLOCK DIAGRAM

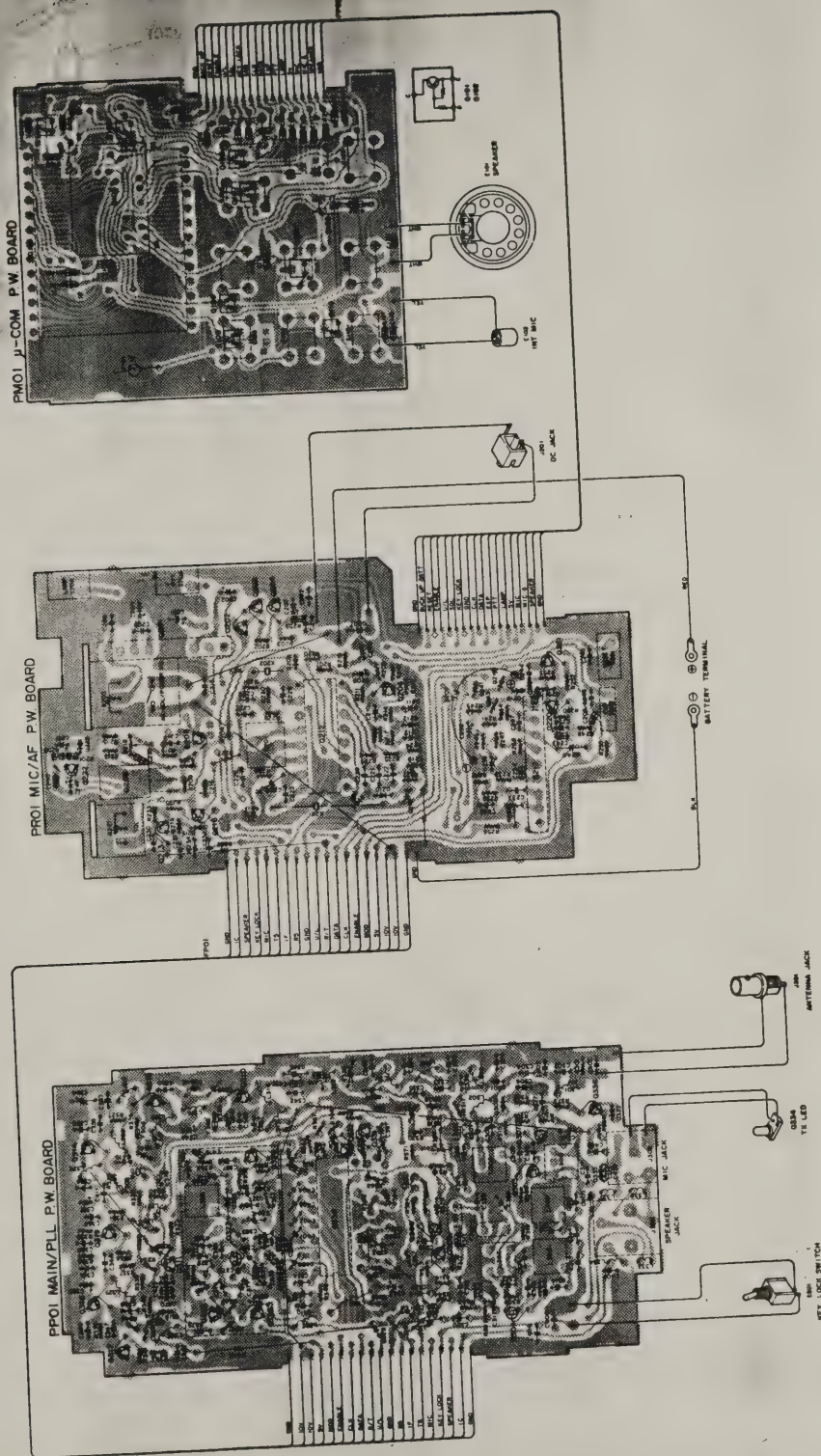


FIGURE 9. P.C. BOARD LAYOUT

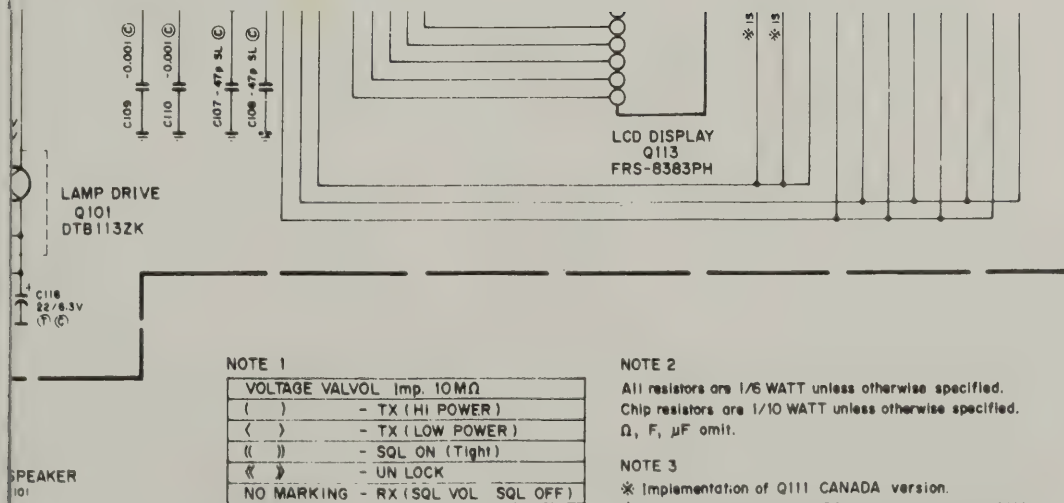
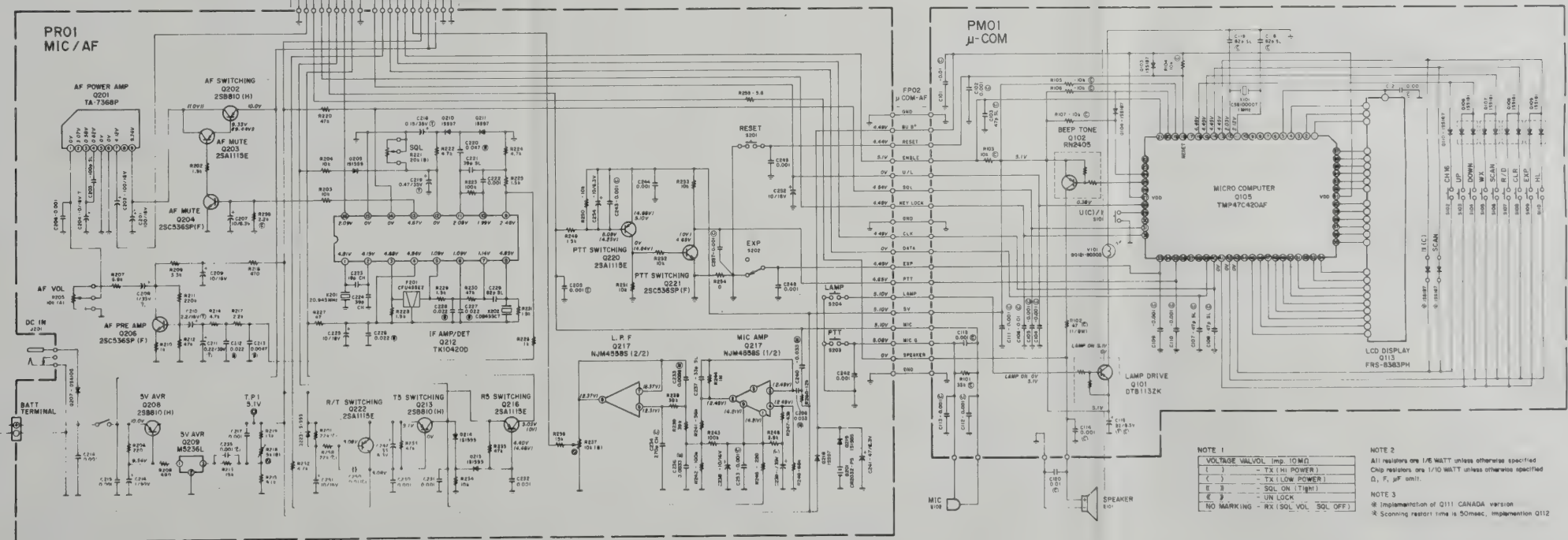


FIGURE 8. SCHEMATIC DIAGRAM

FIGURE 10. EXPLODED PARTS VIEW



NOTE 1

VOLTAGE VALVOL (mp. 10MΩ)	
{ }	- TX (HI POWER)
{ }	- TX (LOW POWER)
{ }	- SQL ON (Tight)
{ }	- UN LOCK
NO MARKING	- RX (SQL VOL SQL OFF)

NOTE 2

All resistors are 1/8 WATT unless otherwise specified
Chip resistors are 1/10 WATT unless otherwise specified
 Ω , F, μ F omit.

NOTE 3

* Implementation of Q111 CANADA version
* Scanning restart time is 50msec, implementation Q112

NOTE 3
 ※ Implementation of Q111 CANADA version
 ※ Scanning restart time is 50msec, implementation Q112

FIGURE 8. SCHEMATIC DIAGRAM

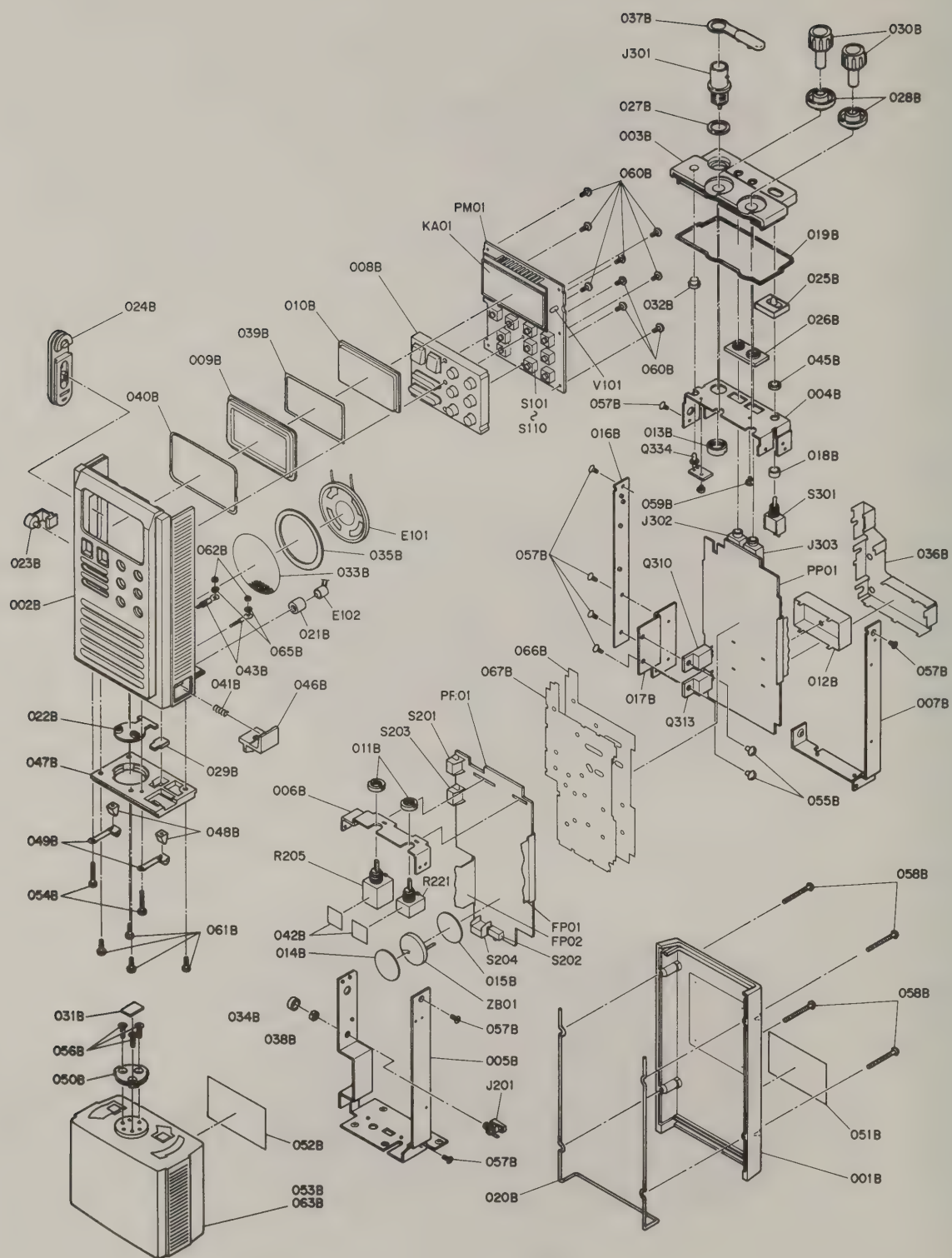


FIGURE 10. EXPLODED PARTS VIEW

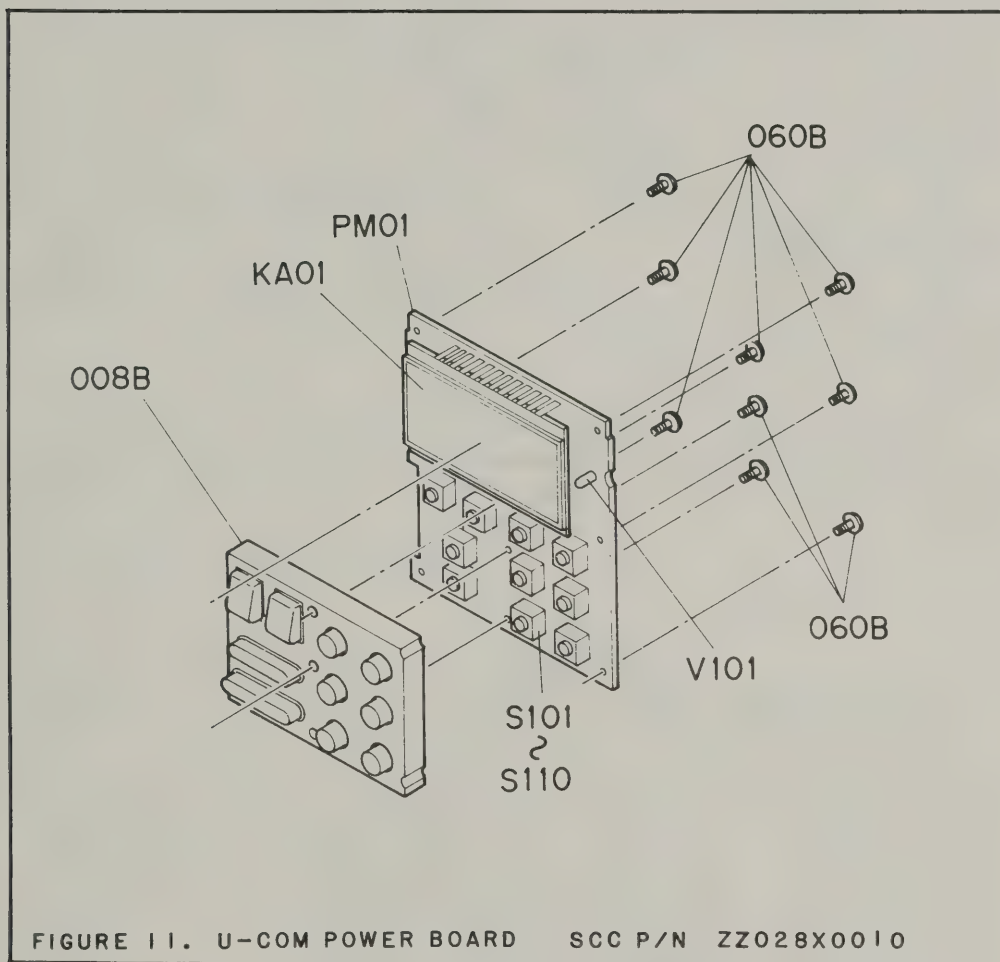
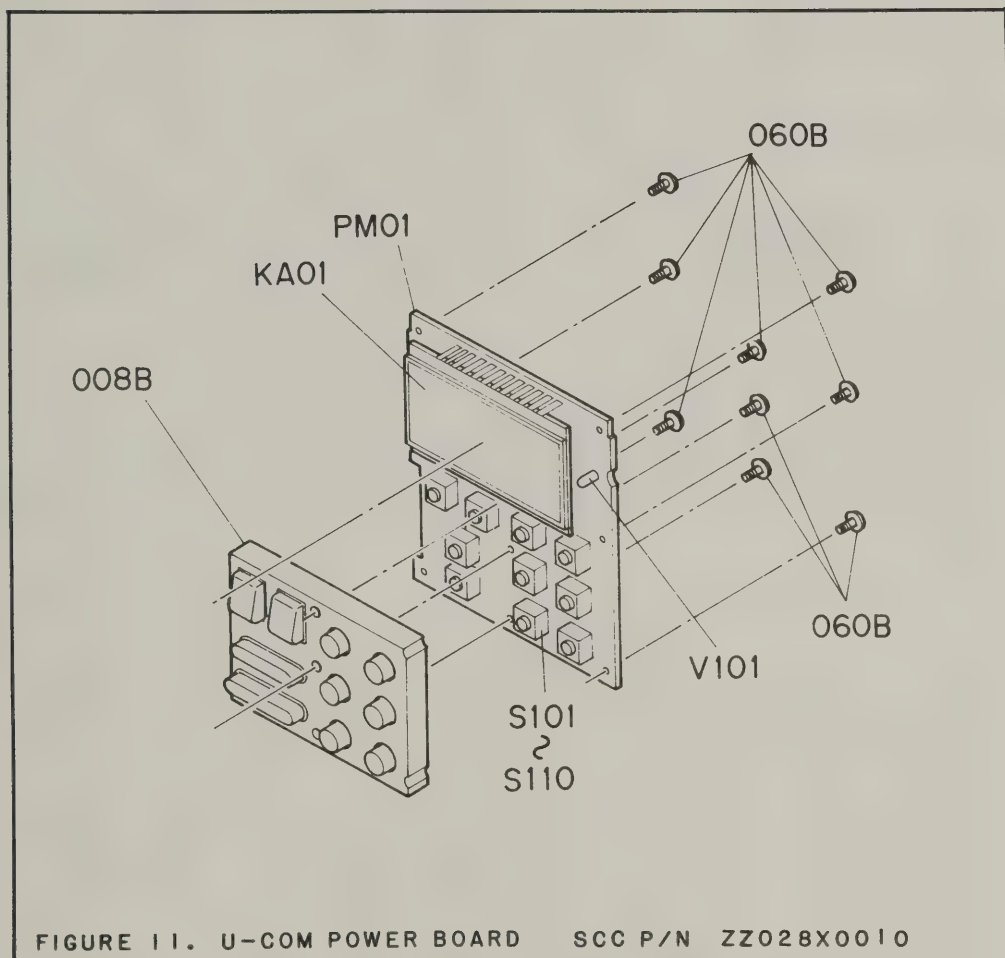
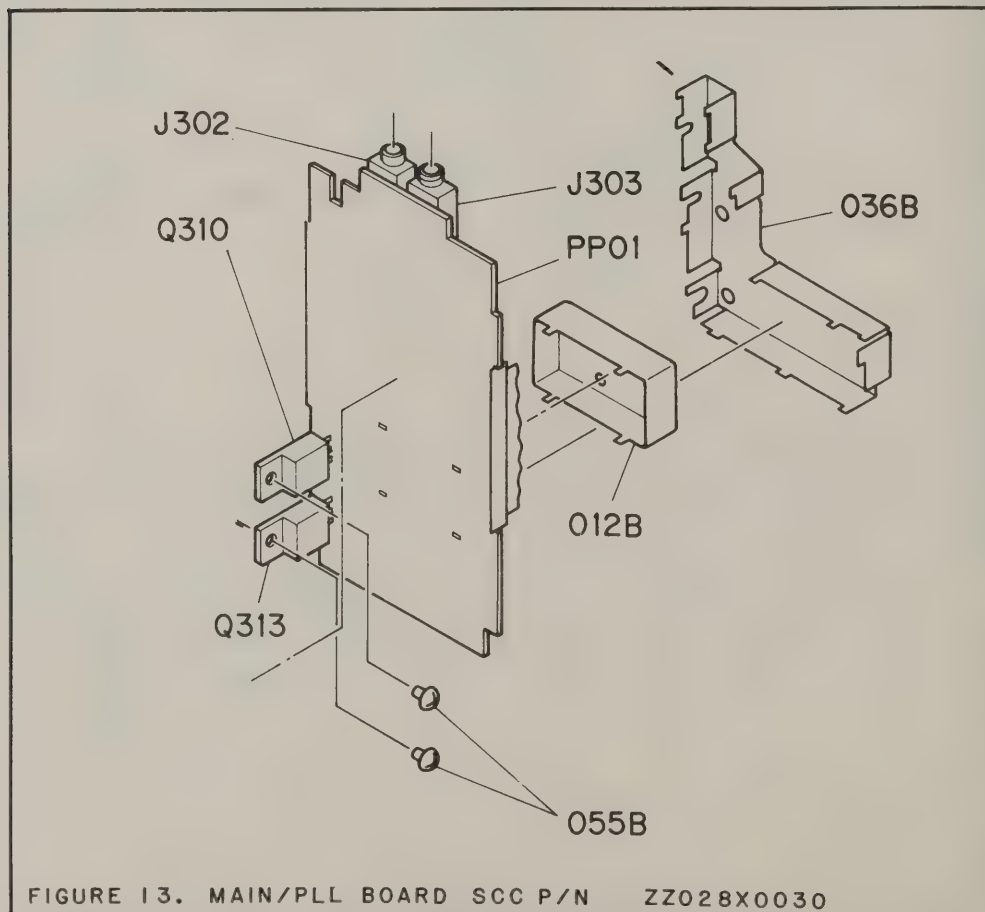
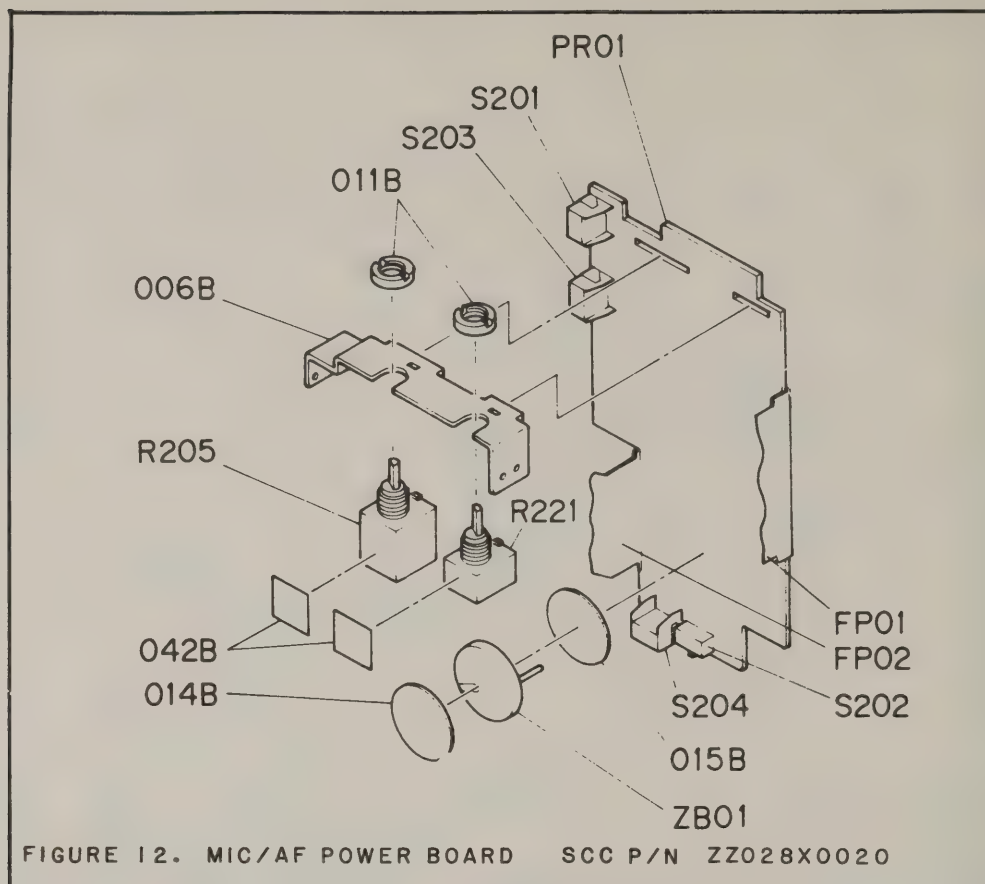




FIGURE 9. P.C. BOARD LAYOUT





PARTS LIST

7

7.1 GENERAL

Information on significant mechanical parts and all electrical parts, excepting common resistors, is included in the parts lists. Parts in each list are listed by reference designators in alphanumeric order. Those parts which share the same value and SCC part number are grouped together.

Because it is more economical to replace certain minor P.C. boards rather than service them, they are offered as assemblies and their parts are not listed. The piece parts of minor P.C. boards that can be economically serviced are listed along with their assembly part number.

7.2 ORDERING REPLACEMENT PARTS

Standard Communications Corp. (SCC) may not be able to fill replacement parts orders that are without such identifying information as: reference designator, value, description, part number, and unit model number.

To replace orders, phone the SCC Parts Department at (213) 532-5300, extension 248, or write:

SCC Parts Department
P.O. Box 92151
Los Angeles, CA 90009-2151

Crystals or crystal filters must be ordered through the Frequency Management Department, at the number listed above, extension 251, or the above address.

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
CAPACITORS				
CV26			CAPACITOR, FEEDTHRU 2000PF	DC18202070
CV27			CAPACITOR, CERAMIC CHIP 470 PF	DD55471300
CV28			CAPACITOR, CERAMIC 3 PF	DD10030300
C101			CAPACITOR, CERAMIC CHIP 10 PF	DD51100330
C101			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C102			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C103			CAPACITOR, CERAMIC CHIP 47 PF	DD55470370
C104			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C105			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C106			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C107			CAPACITOR, CERAMIC CHIP 47 PF	DD55470370
C108			CAPACITOR, CERAMIC CHIP 47 PF	DD55470370
C109			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C110			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C111			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C112			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C113			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C114			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C115			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C116			CAPACITOR TANTA CHIP 22UF 6.3V	EY22600610
C118			CAPACITOR, CERAMIC CHIP 82 PF	DD55820370
C119			CAPACITOR, CERAMIC CHIP 82 PF	DD55820370
C120			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C121			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C201			CAPACITOR, ELECT 100 UF 16V	EJ1070161R
C202			CAPACITOR, ELECT 100 UF 16V	EJ1070161R
C203			CAPACITOR, CERAMIC 100 PF	DD15101370
C204			CAPACITOR, TANTALUM 10 UF 16V	EV10601660
C205			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
CAPACITORS				
C206			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C207			CAPACITOR, ELECT 10 UF 6.3V	EJ1060062R
C208			CAPACITOR, ELECT 1 UF 35V	EV10503560
C209			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C210			CAPACITOR, TANTALUM 2.2UF 16V	EV22501670
C211			CAPACITOR, TANTALUM 0.22 UF 35V	EV22403560
C212			CAPACITOR, SEMICON 0.022 UF	DS17223010
C213			CAPACITOR, SEMICON 0.0047 UF	DS17472010
C214			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C215			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C216			CAPACITOR, ELECT 1 UF 50V	EJ10505010
C217			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C218			CAPACITOR, TANTALUM 0.15 UF 35V	EV15403560
C219			CAPACITOR, TANTALUM 0.47 UF 35V	EV47403560
C220			CAPACITOR, SEMICON 0.047 UF	DS17473010
C221			CAPACITOR, CERAMIC 39 PF	DD15390370
C222			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C223			CAPACITOR, CERAMIC 18 PF	DD15180300
C224			CAPACITOR, CERAMIC 39 PF	DD15390300
C225			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C226			CAPACITOR, SEMICON 0.022 UF	DS17223010
C227			CAPACITOR, SEMICON 0.022 UF	DS17223010
C228			CAPACITOR, SEMICON 0.022 UF	DS17223010
C229			CAPACITOR, CERAMIC CHIP 82PF	DD15820370
C230			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C231			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C232			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C233			CAPACITOR, FILM 0.0056 UF	DF15562350
C234			CAPACITOR, CERAMIC CHIP 270 PF	DD55271300
C235			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C236			CAPACITOR, SEMICON 0.0033 UF	DS17332010
C237			CAPACITOR, CERAMIC 33 PF	DD15330370
C238			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C239			CAPACITOR, ELECT 1 UF 35V	EV10503560
C240			CAPACITOR, FILM 0.033 UF	DF15333310
C241			CAPACITOR, ELECT 47 UF 6V	EJ47600610
C242			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C243			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C244			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C245			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C246			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C247			CAPACITOR, ELECT 33 UF 6.3V	EJ33600610
C250			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C251			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C252			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C253			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C254			CAPACITOR, ELECT 10 UF 6.3V	EJ1060062R
C256			CAPACITOR, FILM 0.033 UF	DF15333310
C257			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C301			CAPACITOR, CERAMIC 16 PF	DD15160300
C302			CAPACITOR, CERAMIC 6 PF	DD11060300
C303			CAPACITOR, CERAMIC 39 PF	DD15390370
C304			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C305			CAPACITOR, CERAMIC 22 PF	DD15220370
C306			CAPACITOR, CERAMIC 100 PF	DD15101370
C307			CAPACITOR, CERAMIC 47 PF	DD15470370
C308			CAPACITOR, CERAMIC 4PF	DD10040370
C309			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C310			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C311			CAPACITOR, CERAMIC 7 PF	DD11070370

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
CAPACITORS				
C312			CAPACITOR, CERAMIC 1 PF	DD10010300
C313			CAPACITOR, CERAMIC 8PF	DD11080370
C314			CAPACITOR, CERAMIC 1 PF	DD10010300
C315			CAPACITOR, CERAMIC 7 PF	DD11070370
C316			CAPACITOR, CERAMIC 47 PF	DD15470370
C317			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C318			CAPACITOR, CERAMIC 22 PF	DD15220370
C319			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C320			CAPACITOR, CERAMIC 47 PF	DD15470370
C321			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C322			CAPACITOR, CERAMIC 56 PF	DD15560370
C323			CAPACITOR, CERAMIC 6PF	DD11060370
C324			CAPACITOR, SEMICON 0.01 UF	DS17103010
C325			CAPACITOR, SEMICON 0.01 UF	DS17103010
C326			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C327			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C328			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C329			CAPACITOR, CERAMIC 15 PF	DD15150300
C330			CAPACITOR, CERAMIC 6 PF	DD11060300
C331			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C332			CAPACITOR, CERAMIC 22 PF	DD15220300
C333			CAPACITOR, CERAMIC 2 PF	DD10020300
C334			CAPACITOR, CERAMIC 27PF	DD15270370
C335			CAPACITOR, CERAMIC 1 PF	DD10010300
C336			CAPACITOR, CERAMIC 1 PF	DD10010300
C337			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C338			CAPACITOR, TRIMMING 35PF	CT1350001R
C339			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C340			CAPACITOR, CERAMIC 22 PF	DD15220300
C341			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C343			CAPACITOR, CERAMIC 33 PF	DD15330300
C343			CAPACITOR, TRIMMING 35PF	CT1350001R
C344			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C345			CAPACITOR, CERAMIC 15 PF	DD15150300
C346			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C347			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C348			CAPACITOR, TRIMMING 35PF	CT1350001R
C349			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C350			CAPACITOR, CERAMIC 27 PF	DD15270300
C351			CAPACITOR, SEMICON 0.022 UF	DS17223010
C352			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C353			CAPACITOR, CERAMIC 33 PF	DD15330300
C354			CAPACITOR, TRIMMING 35PF	CT1350001R
C355			CAPACITOR, CERAMIC 15 PF	DD15150300
C356			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C357			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C358			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C359			CAPACITOR, CERAMIC 27 PF	DD15270300
C360			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C361			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C362			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C363			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C364			CAPACITOR, CERAMIC 22 PF	DD15220370
C365			CAPACITOR, ELECT 10 UF 16V	EJ10601610
C366			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C367			CAPACITOR, CERAMIC 10 PF	DD11100370
C368			CAPACITOR, CERAMIC 12 PF	DD15120370
C369			CAPACITOR, ELECT 47 UF 6V	EJ47600610
C370			CAPACITOR, CERAMIC 0.001 UF	DK16102300

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
CAPACITORS				
C371			CAPACITOR, ELECT 1 UF 50V	EJ10505010
C372			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C373			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C374			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C375			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C376			CAPACITOR, CERAMIC 1 PF	DD10010300
C377			CAPACITOR, CERAMIC 1 PF	DD10010300
C378			CAPACITOR, ELECT 47UF 6.3V	EJ4760062R
C379			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C380			CAPACITOR, CERAMIC 4 PF	DD10040360
C381			CAPACITOR, CERAMIC 3 PF	DD10030360
C382			CAPACITOR, CERAMIC 1PF	DD1001036R
C383			CAPACITOR, CERAMIC 100 PF	DD15101370
C384			CAPACITOR, TRIMMING 10 PF	CT11000180
C385			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C386			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C387			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C388			CAPACITOR, ELECT 22 UF 6.3V	EJ22600610
C389			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C390			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C391			CAPACITOR, CERAMIC 27PF	DD15270340
C392			CAPACITOR, CERAMIC 27PF	DD15270340
C393			CAPACITOR, TRIMMING 20 PF	CT12000130
C394			CAPACITOR, ELECT 47 UF 6V	EJ47600610
C395			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C396			CAPACITOR, TANTALUM 0.1 UF 35V	EV10403560
C397			CAPACITOR, TANTALUM 2.2 UF 10V	EV22501070
C398			CAPACITOR, TANTALUM 0.22 UF 35V	EV22403560
C399			CAPACITOR, TANTALUM 0.33 UF 35V	EV33403560
C400			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C401			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C402			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C403			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C404			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C405			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C406			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C407			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C408			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C409			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C410			CAPACITOR, CERAMIC 8 PF	DD11080300
C411			CAPACITOR, CERAMIC 10 PF	DD11100370
C412			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C413			CAPACITOR, CERAMIC 0.001 UF	DK16102300
C414			CAPACITOR, CERAMIC CHIP 10 PF	DD51100330
C415			CAPACITOR, CERAMIC CHIP 27 PF	DD55270330
C416			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C417			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C418			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C419			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C420			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C421			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C422			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300
C423			CAPACITOR, CERAMIC CHIP 0.01 UF	DK56103300
C425			CAPACITOR, CERAMIC CHIP 0.001UF	DK56102300

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
INDUCTORS				
L301			COIL, AIR 0.5UEW D3 3.5T	ML030050AR
L302			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L303			COIL, ANTENNA 5K 150M	LA5501626R
L304			COIL, ANTENNA 5K 150M	LA5501627R
L305			COIL, ANTENNA 5K 150M	LA5501627R
L306			COIL, ANTENNA 5K 150M	LA5501627R
L307			COIL, ANTENNA 5K 21.4M	LA5501628R
L308			COIL, CHOKE LAL02NA2R2M	LC1222008R
L309			COIL, AIR 0.5UEW D3 3.5T	ML030050AR
L310			COIL, AIR 0.5UEW D3 3.5T	ML030050AR
L311			COIL, AIR 0.65UEW D3 2.5T	ML0300652R
L312			COIL, AIR 2.5T	ML0300655R
L313			COIL, AIR 6.5T	ML030050DR
L314			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L315			COIL, CHOKE 0.5UEW 1.5T	LC12000050
L316			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L317			COIL, CHOKE LAL02NA4R7K	LC1472009R
L318			COIL, CHOKE LAL02NA4R7K	LC1472009R
L319			COIL, CHOKE 0.5UEW 1.5T	LC12000050
L320			COIL, CHOKE LAL02NA4R7K	LC1472009R
L321			COIL, CHOKE LAL02NA4R7K	LC1472009R
L322			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L323			COIL, AIR 2.5T	ML03005060
L324			COIL, AIR 5.5T	ML030050CR
L325			COIL, AIR 6.5T	ML030050DR
L326			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L327			COIL, AIR 0.5UEW D3 4.5T	ML030050BR
L328			COIL, CHOKE LAL02NA2R2M	LC1222008R
L329			COIL, ANTENNA 5K 150M	LA5501629R
L330			COIL, CHOKE LA02NA100K	LC1103015R
L331			COIL, CHOKE 1UH	LC1102013R
L332			COIL, CHOKE 1UH	LC1102013R
L333			COIL, CHOKE 1UH	LC1102013R
L334			COIL, CHOKE 1UH	LC1102013R

SEMICONDUCTORS

Q101	COMP, SEMICON DTB113ZK	BA1000421R
Q102	COMP, SEMICON RN2405	BA1000105R
Q103	DIODE, CHIP 1SS187	HZ2000605R
Q104	DIODE, CHIP 1SS187	HZ2000605R
Q105	TMP47C420AF U-COM GX2310S	HU10002050
Q106	DIODE, CHIP 1SS181	HZ2000705R
Q107	DIODE, CHIP 1SS181	HZ2000705R
Q108	DIODE, CHIP 1SS181	HZ2000705R
Q109	DIODE, CHIP 1SS181	HZ2000705R
Q110	DIODE, CHIP 1SS187	HZ2000605R
Q113	DISPLAY, LCD	KZ0500100R
Q201	I.C. TA7368P	HC10119050
Q202	TRANSISTOR 2SBB10H	HT208101HR
Q203	TRANSISTOR, 2SA1115E	HT111151ER
Q204	TRANSISTOR 2SC536	HT305360F0
Q205	DIODE 1S1555	HD20011050
Q206	TRANSISTOR 2SC536	HT305360F0
Q207	DIODE DSA10G	HD2003203R
Q208	TRANSISTOR 2SBB10H	HT208101HR
Q209	I.C. M5236L 5V REG	HC3810520R
Q210	DIODE 1SS97	HD20012060

HANDHELD MARINE TRANSCEIVER

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
SEMICONDUCTORS				
Q211			DIODE 1SS97	HD20012060
Q212			I.C. TK10420	HC10007420
Q213			TRANSISTOR 2SB810H	HT208101HR
Q214			DIODE 1S1555	HD20011050
Q215			DIODE 1S1555	HD20011050
Q216			TRANSISTOR, 2SA1115E	HT111151ER
Q217			I.C. NJM4558S	HC10014090
Q218			DIODE 1SS97	HD20012060
Q219			DIODE 1S1555	HD20011050
Q220			TRANSISTOR, 2SA1115E	HT111151ER
Q221			TRANSISTOR 2SC536	HT305360F0
Q222			TRANSISTOR, 2SA1115E	HT111151ER
Q223			DIODE 1S1555	HD20011050
Q301			DIODE M1301	HD20001200
Q302			DIODE M1301	HD20001200
Q303			TRANSISTOR F.E.T. 2SK241Y	HF202411B0
Q304			TRANSISTOR F.E.T. 2SK241Y	HF202411B0
Q305			TRANSISTOR 2SC2999E	HT329991ER
Q306			DIODE 1S2588	HD2000109R
Q307			TRANSISTOR 2SC536	HT305360F0
Q308			DIODE 1SS97	HD20012060
Q309			TRANSISTOR 2SC2458	HT324581Y0
Q310			TRANSISTOR 2SC1971	HT31971100
Q311			TRANSISTOR 2SC2458	HT324581Y0
Q312			DIODE 1S1555	HD20011050
Q313			TRANSISTOR 2SC1971	HT31971100
Q314			TRANSISTOR 2SC2538	HT32538100
Q315			TRANSISTOR 2SC2053	HT32053000
Q316			TRANSISTOR 2SC2026	HT32026100
Q317			TRANSISTOR 2SC2458GR	HT324581G0
Q318			DIODE 1S2588	HD2000109R
Q319			DIODE 1S1555	HD20011050
Q320			TRANSISTOR 2SC2026	HT32026100
Q322			TRANSISTOR 2SC2026	HT32026100
Q323			TRANSISTOR F.E.T. 2SK192Y	HF201921A0
Q324			VARICAP 1SV53B	HD4002209R
Q325			VARICAP 1S2208MB	HD40002060
Q326			VARICAP 1S2208MB	HD40002060
Q327			DIODE 1SS91G	HD2000209R
Q328			TRANSISTOR 2SC536	HT305360F0
Q329			DIODE 1S1555	HD20011050
Q330			IC M54959 P PLL	HC10051200
Q331			TRANSISTOR 2SC2458Y	HT324581K0
Q332			TRANSISTOR 2SC2458Y	HT324581K0
Q333			DIODE, ZENER GZA7.5Y	HD3000903R
Q334			L.E.D. SLH-34VC3F	H11004821R
Q335			DIODE, ZENER GZA6.2X	HD3000403R
Q336			TRANSISTOR 2SC2458	HT324581Y0

RESISTORS

R101	RESISTOR, CHIP 33K OHM 1/10W	NI05333110
R102	RESISTOR, CHIP 47 OHM 1/8W	RI05470180
R103	RESISTOR, CHIP 10K OHM 1/10W	NI05103110
R104	RESISTOR, CHIP 10K OHM 1/10W	NI05103110
R105	RESISTOR, CHIP 10K OHM 1/10W	NI05103110
R106	RESISTOR, CHIP 10K OHM 1/10W	NI05103110
R107	RESISTOR, CHIP 10K OHM 1/10W	NI05103110
R201	RESISTOR, CHIP 22K OHM 1/10W	NI05223110

REF	MODEL	SERIAL NO.	DESCRIPTION	PART
DES	EFF	EFFECTIVITY		NUMBER
RESISTORS				
R202			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R203			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R204			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R205			RESISTOR, VARIABLE 10K	RB1103012R
R206			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R207			RES, CRBN FLM 6.8K OHM 1/6W	GD05682160
R208			RESISTOR 680 OHM	GD05681160
R209			RES, CRBN FLM 3.3K OHM 1/6W	GD05332160
R210			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R211			RES, CRBN FLM 220K OHM 1/6W	GD05224160
R212			RESISTOR, CRBN FLM 47K OHM 1/6W	GD05473160
R213			RESISTOR, CRBN FLM 15K OHM 1/6W	GD05153160
R214			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R215			RESISTOR, CRBN FLM 5.1K OHM 1/6W	GD05512160
R216			RESISTOR, CRBN FLM 470 OHM 1/6W	GD05471160
R217			RES, CRBN FLM 2.2K OHM 1/6W	GD05222160
R218			RESISTOR, TRIMMING 5K OHM	RA05020390
R219			RESISTOR, CRBN FLM 13K OHM 1/6W	GD05133160
R220			RESISTOR, CRBN FLM 47K OHM 1/6W	GD05473160
R221			RESISTOR, VARIABLE 20K	RB02030220
R222			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R223			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R224			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R225			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R226			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R227			RESISTOR, CRBN FLM 47 OHM 1/6W	GD05470160
R228			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R229			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R230			RESISTOR, CRBN FLM 47K OHM 1/6W	GD05473160
R231			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R232			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R233			RESISTOR, CRBN FLM 47K OHM 1/6W	GD05473160
R234			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R235			RESISTOR, CRBN FLM 47K OHM 1/6W	GD05473160
R237			RESISTOR, TRIMMING 10K OHM	RA01030730
R238			RESISTOR 39K OHM 1/6W	GD05393160
R239			RESISTOR 39K OHM 1/6W	GD05393160
R241			RES, CRBN FLM 56K OHM 1/6W	GD05563160
R242			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R243			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R244			RESISTOR, CRBN FLM 1M OHM 1/6W	GD05105160
R245			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R246			RES, CRBN FLM 3.9K OHM 1/6W	GD05392160
R247			RESISTOR, CRBN FLM 43K OHM 1/6W	GD05433160
R248			RESISTOR, TRIMMING 68K OHM 1/6W	GD05683160
R249			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R250			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R251			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R252			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R253			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R254			RESISTOR, CRBN FLM 0 OHM 1/6W	GD05000160
R255			RESISTOR, CRBN FLM 5.6 OHM 1/6W	GD05056160
R256			RESISTOR, CRBN FLM 15K OHM 1/6W	GD05153160
R258			RESISTOR, CHIP 22K OHM 1/10W	NI05223110
R259			RESISTOR, CHIP 2.2K OHM 1/10W	NI05222110
R260			RESISTOR, CRBN FLM 12K OHM 1/6W	GD05123160
R301			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R302			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R303			RESISTOR, CRBN FLM 82 OHM 1/6W	GD05820160

REF DES	MODEL EFF	SERIAL NO. EFFECTIVITY	DESCRIPTION	PART NUMBER
RESISTORS				
R304			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R305			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R306			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R307			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R308			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R309			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R310			RESISTOR, CRBN FLM 82 OHM 1/6W	GD05820160
R311			RESISTOR, CHIP 1.2K OHM 1/10W	NI05122110
R312			RESISTOR, CHIP 680K OHM 1/10W	NI05684110
R313			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R314			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R315			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R316			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R317			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R318			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R319			RESISTOR, CRBN FLM 0 OHM 1/6W	GD05000160
R320			RESISTOR, TRIMMING 10K OHM	RA01030730
R321			RES, CRBN FLM 3.3K OHM 1/6W	GD05332160
R322			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R323			RES, CRBN FLM 2.2K OHM 1/6W	GD05222160
R324			RESISTOR, CRBN FLM 10 OHM 1/6W	GD05100160
R325			RESISTOR, CRBN FLM 4.7 OHM 1/6W	GD05047160
R326			RESISTOR, CRBN FLM 10 OHM 1/6W	GD05100160
R327			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R328			RESISTOR, CRBN FLM 0 OHM 1/6W	GD05000160
R329			RESISTOR, CRBN FLM 47 OHM 1/6W	GD05470160
R330			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R331			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R332			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R333			RESISTOR, CRBN FLM 47 OHM 1/6W	GD05470160
R334			RESISTOR, CRBN FLM 120 OHM 1/6W	GD05121160
R335			RESISTOR, CRBN FLM 150 OHM 1/6W	GD05151160
R336			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R337			RESISTOR, CRBN FLM 470 OHM 1/6W	GD05471160
R338			RESISTOR, CRBN FLM 470 OHM 1/6W	GD05471160
R339			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R340			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R341			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R342			RESISTOR, CRBN FLM 5.1K OHM 1/6W	GD05512160
R343			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R344			RESISTOR, CRBN FLM 22 OHM 1/6W	GD05220160
R345			RESISTOR, CRBN FLM 470 OHM 1/6W	GD05471160
R346			RESISTOR, CRBN FILM 1K OHM 1/6W	GD05102160
R347			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R348			RESISTOR, CRBN FLM 22K OHM 1/6W	GD05223160
R349			RES, CRBN FLM 3.9K OHM 1/6W	GD05392160
R350			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R351			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R352			RESISTOR, CRBN FLM 82 OHM 1/6W	GD05820160
R353			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R354			RESISTOR, CHIP 47K OHM 1/10W	NI05473110
R355			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R356			RES, CRBN FLM 5.6K OHM 1/6W	GD05562160
R357			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R358			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R359			RES, CRBN FLM 100K OHM 1/6W	GD05104160
R360			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160
R362			RESISTOR, CRBN FLM 100 OHM 1/6W	GD05101160
R363			RES, CRBN FLM 2.2K OHM 1/6W	GD05222160
R364			RES, CRBN FLM 5.6K OHM 1/6W	GD05562160

REF	MODEL	SERIAL NO.	DESCRIPTION	PART
DES	EFF	EFFECTIVITY		NUMBER

RESISTORS

R365			RES, CRBN FLM 6.8K OHM 1/6W	GD05682160
R366			RES, CRBN FLM 1.5K OHM 1/6W	GD05152160
R367			RES, CRBN FLM 4.7K OHM 1/6W	GD05472160
R368			RES, CRBN FLM 330 OHM 1/6W	GD05331160
R369			RESISTOR, CRBN FLM 220 OHM 1/6W	GD05221160
R370			RES, CRBN FLM 220K OHM 1/6W	GD05224160
R371			RES, CRBN FLM 1.8K OHM 1/6W	GD05182160
R372			RESISTOR, CRBN FLM 0 OHM 1/6W	GD05000160
R373			RESISTOR, CRBN FLM 10K OHM 1/6W	GD05103160

MISCELLANEOUS ELECTRICAL

B201			BATTERY	ZB0903001R
E101			SPEAKER INT S-T402	QK0040901R
E102			ELEMENT, MICROPHONE	MS50000100
FP01			FPC AF-RF FLEXIBLE	WE028X011R
FP02			FPC SF-U COM FLEXIBLE	WE028X012R
F201			FILTER, CERAMIC 455 KHZ	FG455304E0
F301			CRYSTAL FILTER 21.400 MHZ	XU821400N5
F303			CORE, FERRITE	FC5004001R
F304			CORE, FERRITE	FC5004001R
F305			CORE, FERRITE	FC5004001R
J201			JACK	YJ0400136R
J301			JACK BNC	YJ1000237R
J302			JACK, MIC HSJ0838-01-010	YJ01002400
J303			JACK SPEAKER HSJ0836-01-010	YJ01001840
S101			SWITCH, PUSH	SP01010570
S102			SWITCH, PUSH	SP01010570
S103			SWITCH, PUSH	SP01010570
S104			SWITCH, PUSH	SP01010570
S105			SWITCH, PUSH	SP01010570
S106			SWITCH, PUSH	SP01010570
S107			SWITCH, PUSH	SP01010570
S108			SWITCH, PUSH	SP01010570
S109			SWITCH, PUSH	SP01010570
S110			SWITCH, PUSH	SP01010570
S201			SWITCH, PUSH	SP01011040
S202			SWITCH, SLIDE	SS0102061R
S203			SWITCH, PUSH	SP01011040
S204			SWITCH, PUSH	SP01011040
S301			SWITCH MS-610-K-B	SC0102052R
V101			LAMP BQ121-20303	IN1005013R
X101			CERAMIC VIB. CSB1000D	FQ01004010
X201			20.945 XTAL	XL001001GR
X202			DISCRIMINATOR, CERAMIC	FH455301B0
X301			12.8 XTAL FOR PLL	XL125001G0

MISCELLANEOUS MECHANICAL

001B			CASE REAR	028X064010
001S			SLEEVE	028X804010
001V			CARRYING CASE VINYL	028X831010
002B			CASE FRONT	028X064020
003B			ESCUTCHEON TOP PANEL	028X063010
004B			CHASSIS TOP	028X105010
005B			CHASSIS AF (1)	028X105020
006B			CHASSIS AF (2)	028X105030

HANDHELD MARINE TRANSCEIVER

REF	MODEL	SERIAL NO.	DESCRIPTION	PART
DES	EFF	EFFECTIVITY		NUMBER
MISCELLANEOUS MECHANICAL				
007B			CHASSIS RF	028X105040
008B			BUTTON, KEY BOARD	028X270020
009B			FRAME, LCD WINDOW	028X401010
010B			WINDOW, LCD	028X158010
011B			SHIELD, PANEL	296Z120020
013B			S.C. NUT	53228119E0
014B			SHEET, BATT SEAL	296Z107020
015B			SHEET BATT SHEET	296Z107030
016B			CHASSIS RF CHASSIS	028X105050
017B			HEATSINK	028X267010
018B			SHIELD, LOCK KEY	028X109010
019B			PACKING TOP CASE	028X277010
020B			PACKING, REAR CASE	028X277020
021B			PACKING MIC	028X277030
022B			LID RESET EXT. CAP	028X257010
023B			LID DC JACK CAP	028X257020
024B			BUTTON, PTT	028X270012
025B			CAP LOCK SW KEY	028X067020
026B			PACKING MIC SPK JACK	028X277040
027B			PACKING BNC CONNECTOR	028X277050
028B			PACKING VOL SQL	028X277060
029B			LOCK, TWIST	028X102010
030B			KNOB SQL, VOL	028X154010
032B			INTRODUCER, LED	028X151010
033B			NET, SPK	028X202010
034B			PACKING DC JACK	028X277070
035B			SPACER	028X118010
036B			SHIELD, PANEL	028X109050
037B			CAP, MIC, SPK	028X067010
038B			NUT	028X011010
039B			STICKER LCD WINDOW FRAME	028X122010
040B			STICKER LCD FRAME	028X122020
041B			SPRING	028X115010
042B			INSULATOR, VOL, SQL	028X120020
043B			LUG NLA	62261240W0
045B			NUT	028X011020
046B			STOPPER	111C114020
047B			GUIDE	111C051020
048B			BUFFER	111C056010
049B			CONTACTOR	111C123010
050B			LOCK	111C102010
051B			INDICATOR	028X265010
052B			INDICATOR	412C265020
054B			SCREW, P H M	51060212L0
056B			SCREW, P H M	51502606D0
057B			F.H.M. SCREW NLA	51040204A0
058B			SCREW	028X010010
061B			P.H. TAP. SCREW	51302606D0
062B			NUT	028X011050
065B			T.L. WASHER OR NLA	54052600R0
066B			SHIELD	028X109060
067B			INSULATOR	028X120100
068B			TUBE	028X152010
069B			STICKER	028X122030
070B			TAPE	028X157010
201B			CASE	111C064050
202B			LID	412C257010

USA VHF MARINE CHANNEL CHART

CHANNEL	TRANSMITTER FREQUENCY	RECEIVER FREQ	MODE S/D	CHANNEL ASSIGNMENT
01	156.050	156.050	S	Public Correspondence, Port Operation
05	156.250	156.250	S	Public Correspondence, Port Operation
06	156.300	156.300	S	Safety (Compulsory)
07	156.350	156.350	S	Commercial
08	156.400	156.400	S	Commercial, Inter-ship
09	156.450	156.450	S	Commercial/Non-Commercial
10	156.500	156.500	S	Commercial
11	156.550	156.550	S	Commercial, VTS
12	156.600	156.600	S	Port Operation, VTS
13	156.650	156.650	S	Bridge to Bridge, (1W) Navigational
14	156.700	156.700	S	Port Operation, VTS
15		156.750	S	Recv Only-Coast to Ship
16	156.800	156.800	S	Calling & Safety, Compulsory
17	156.850	156.850	S	State Controlled Ship to Coast (1W)
18	156.900	156.900	S	Commercial
19	156.950	156.950	S	Port Operation
20	157.000	161.600	D	Port Operation
21	157.050	157.050	S	U.S. Govt. Only
22	157.100	157.100	S	Liaison (USCG only)
23	157.150	157.150	S	Port Operation (U.S Govt. Only)
24	157.200	161.800	D	Public Correspondence
25	157.250	161.850	D	Public Correspondence
26	157.300	161.900	D	Public Correspondence
27	157.350	161.950	D	Public Correspondence
28	157.400	162.000	D	Public Correspondence
63	156.175	156.175	S	Public Correspondence, Port Operation
64		160.825	D	Public Correspondence, Port Operation
65	156.275	156.275	S	Port Operation, VTS
66	156.325	156.325	S	Port Operation, VTS
67	156.375	156.375	S	Commercial, VTS
68	156.425	156.425	S	Non-Commercial
69	156.475	156.475	S	Non-Commercial
70	156.525	156.525	S	Non-Commercial
71	156.575	156.575	S	Intership, Port Operation, Non-Commercial
72	156.625	156.625	S	Non-Commercial
73	156.675	156.675	S	Port Operation, VTS
74	156.725	156.725	S	Port Operation, VTS
77	156.875	156.875	S	Intership, Port Operation
78	156.925	156.925	S	Non-Commercial
79	156.975	156.975	S	Commercial
80	157.025	157.025	S	Commercial
81	157.075	157.075	S	U.S. Govt. Only
82	157.125	157.125	S	U.S. Govt. Only
83	157.175	157.175	S	U.S. Govt. Only
84	157.225	161.825	D	Public Correspondence
85	157.275	161.875	D	Public Correspondence
86	157.325	161.925	D	Public Correspondence
87	157.375	161.975	D	Public Correspondence
88	157.425	157.425	S	Commercial, Aircraft

USA VHF MARINE CHANNEL CHART

CHANNEL	TRANSMITTER FREQ	RECEIVER FREQUENCY	MODE S/D	CHANNEL ASSIGNMENT
WX01		162.550	D	Weather (Recv Only)
WX02		162.400	D	Weather (Recv Only)
WX03		162.475	D	Weather (Recv Only)
WX04		163.275	D	Weather (Recv Only)
WX05		161.650	D	Weather (Recv Only)
WX06		161.775	D	Weather (Recv Only)
WX07		162.425	D	Weather (Recv Only)
WX08		162.450	D	Weather (Recv Only)
WX09		162.500	D	Weather (Recv Only)
WX10		162.525	D	Weather (Recv Only)

INTERNATIONAL VHF MARINE CHANNEL CHART

CH	TRANSMITTER FREQUENCY	RECEIVER FREQUENCY	MODE S/D	CHANNEL ASSIGNMENT
01	156.050	160.650	D	Public Correspondence, Port Operation
02	156.100	160.700	D	Public Correspondence, Port Operation
03	156.150	160.750	D	Public Correspondence, Port Operation
04	156.200	160.800	D	Public Correspondence, Port Operation
05	156.250	160.850	D	Public Correspondence, Port Operation
06	156.300	156.300	S	Safety (Compulsory)
07	156.350	160.950	D	Public Correspondence, Port Operation
08	156.400	156.400	S	Commercial, Inter-ship
09	156.450	156.450	S	Commercial/Non-Commercial
10	156.500	156.500	S	Commercial
11	156.550	156.550	S	Commercial, VTS
12	156.600	156.600	S	Port Operation, VTS
13	156.650	156.650	S	Bridge to Bridge, (1W) Navigational
14	156.700	156.700	S	Port Operation, VTS
15	156.750	156.750	S	Recv Only-Coast to Ship
16	156.800	156.800	S	Calling & Safety, Compulsory
17	156.850	156.850	S	State Controlled Ship to Coast (1W)
18	156.900	161.500	D	Port Operation
19	156.950	161.550	D	Commercial
20	157.000	161.600	D	Port Operation
21	157.050	161.650	D	Port Operation
22	157.100	161.700	D	Port Operation
23	157.150	161.750	D	Public Correspondence
24	157.200	161.800	D	Public Correspondence
25	157.250	161.850	D	Public Correspondence
26	157.300	161.900	D	Public Correspondence
27	157.350	161.950	D	Public Correspondence
28	157.400	162.000	D	Public Correspondence
60	156.025	160.625	D	Public Correspondence, Port Operation
61	156.075	160.675	D	Public Correspondence, Port Operation
62	156.125	160.725	D	Public Correspondence, Port Operation
63	156.175	160.775	D	Public Correspondence, Port Operation
64	156.225	160.825	D	Public Correspondence, Port Operation
65	156.275	160.875	D	Public Correspondence, Port Operation, VTS
66	156.325	160.925	D	Public Correspondence, Port Operation
67	156.375	156.375	S	Commercial, VTS
68	156.425	156.425	S	Non-Commercial
69	156.475	156.475	S	Non-Commercial
70	156.525	156.525	S	Non-Commercial
71	156.575	156.575	S	Intership, Port Operation, Non-Commercial
72	156.625	156.625	S	Non-Commercial
73	156.675	156.675	S	Port Operation, VTS
74	156.725	156.725	S	Port Operation, VTS
77	156.875	156.875	S	Intership, Port Operation
78	156.925	156.925	D	Port Operation, Public Correspondence
79	156.975	161.575	D	Port Operation, Public Correspondence
80	157.025	161.625	D	Port Operation, Public Correspondence
81	157.075	161.675	D	Port Operation, Public Correspondence
82	157.125	161.725	D	Port Operation, Public Correspondence
83	157.175	161.775	D	Port Operation, Public Correspondence

INTERNATIONAL VHF MARINE CHANNEL CHART

CH	TRANSMITTER FREQUENCY	RECEIVER FREQUENCY	MODE S/D	CHANNEL ASSIGNMENT
84	157.225	161.825	D	Public Correspondence
85	157.275	161.875	D	Public Correspondence
86	157.325	161.925	D	Public Correspondence
87	157.375	161.975	D	Public Correspondence
88	157.425	162.025	D	Port Operations, Public Correspondence
WX01		162.550	D	Weather (Recv Only)
WX02		162.400	D	Weather (Recv Only)
WX03		162.475	D	Weather (Recv Only)
WX04		163.275	D	Weather (Recv Only)
WX05		161.650	D	Weather (Recv Only)
WX06		161.775	D	Weather (Recv Only)
WX07		162.425	D	Weather (Recv Only)
WX08		162.450	D	Weather (Recv Only)
WX09		162.500	D	Weather (Recv Only)
WX10		162.525	D	Weather (Recv Only)

CANADA VHF MARINE CHANNEL CHART

CHANNEL	TRANSMITTER FREQUENCY	RECEIVER FREQUENCY	MODE S/D	CHANNEL ASSIGNMENT
01	156.050	160.650	D	Public Correspondence
02	156.100	160.700	D	Public Correspondence
03	156.150	160.750	D	Public Correspondence
04	156.200	156.200	S	Public Correspondence
05		156.250	S	Public Correspondence
06	156.300	156.300	S	Safety (Intership)
07	156.350	156.350	S	Commercial (Intership/Ship-Coast)
08	156.400	156.400	S	Commercial, Intership
09	156.450	156.450	S	Commercial, (Ship-Coast)
10	156.500	156.500	S	Commercial, (Intership/Ship-Coast)
11	156.550	156.550	S	Commercial, (Intership/Ship-Coast)
12	156.600	156.600	S	Port Operations (Intership/Ship-Coast)
13	156.650	156.650	S	Navigational (Intership/Ship-Coast)
14	156.700	156.700	S	Port Operations (Intership/Ship-Coast)
15	156.750	156.750	S	Weather
16	156.800	156.800	S	Distress, Safety, and Calling
17	156.850	156.850	S	State Control (Ship to Coast)
18	156.900	156.900	S	Commercial (Intership/Ship-Coast)
19	156.950	156.950	S	Commercial (Intership/Ship-Coast)
20	157.000	161.600	D	Port Operations, (Ship-Coast)
21	157.050	157.050	S	Coast Guard
22	157.100	157.100	S	Coast Guard
23	157.150	161.750	D	Coast Guard
24	157.200	161.800	D	Public Correspondence (Ship-Coast)
25	157.250	161.850	D	Public Correspondence (Ship-Coast)
26	157.300	161.900	D	Public Correspondence (Ship-Coast)
27	157.350	161.950	D	Public Correspondence (Ship-Coast)
28	157.400	162.000	D	Public Correspondence (Ship-Coast)
60	156.025	160.625	D	Public Correspondence
61	156.075	156.075	S	Public Correspondence
62	156.125	156.125	S	Public Correspondence
63	156.175	156.175	S	Public Correspondence
64	156.225	160.825	D	Public Correspondence
65	156.275	156.275	S	Port Operations, (Intership/Ship-Coast)
66	156.325	156.325	S	Port Operations (Intership/Ship-Coast)
67	156.375	156.375	S	Commercial, (Intership)
68	156.425	156.425	S	Non-Commercial (Intership/Ship-Coast)
69	156.475	156.475	S	Non-Commercial (Ship-Coast)
70	156.525	156.525	S	Non-Commercial (Intership)
71	156.575	156.575	S	Non-Commercial (Ship-Coast)
72	156.625	156.625	S	Non-Commercial (Intership)
73	156.675	156.675	S	Port Operations (Intership/Ship-Coast)
74	156.725	156.725	S	Port Operations (Intership/Ship-Coast)
77	156.875	156.875	S	Commercial (Intership)

CANADA VHF MARINE CHANNEL CHART

CHANNEL	TRANSMITTER FREQUENCY	RECEIVER FREQ.	MODE S/D	CHANNEL ASSIGNMENT
78	156.925	156.925	S	Non-Commercial (Ship-Coast)
79	156.975	156.975	S	Commercial (Intership/Ship-Coast)
80	157.025	157.025	S	Commercial (Ship-Coast)
81	157.075	157.075	S	Coast Guard
82	157.125	157.125	S	Coast Guard
83	157.175	157.175	S	Coast Guard Auxiliary
84	157.225	161.825	D	Public Correspondence (Ship-Coast)
85	157.275	161.875	D	Public Correspondence (Ship-Coast)
86	157.325	161.925	D	Public Correspondence (Ship-Coast)
87	157.375	161.975	D	Public Correspondence (Ship-Coast)
88	157.425	162.025	D	Commercial (Intership)
WX01		162.550	D	Weather (Recv Only)
WX02		162.400	D	Weather (Recv Only)
WX03		162.475	D	Weather (Recv Only)
WX04		163.275	D	Weather (Recv Only)
WX05		161.650	D	Weather (Recv Only)
WX06		161.775	D	Weather (Recv Only)
WX07		162.425	D	Weather (Recv Only)
WX08		162.450	D	Weather (Recv Only)
WX09		162.500	D	Weather (Recv Only)
WX10		162.525	D	Weather (Recv Only)

EXPANSION CHANNEL SELECTION CHART

CHANNEL NO.	TRANSMITTER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (DUPLEX)
00	156.000	156.000	160.000
01	156.050	156.050	160.650
02	156.100	156.100	160.700
03	156.150	156.150	160.750
04	156.200	156.200	160.800
05	156.250	156.250	160.850
06	156.300	156.300	160.900
07	156.350	156.350	160.950
08	156.400	156.400	161.000
09	156.450	156.450	161.050
10	156.500	156.500	161.100
11	156.550	156.550	161.150
12	156.600	156.600	161.200
13	156.650	156.650	161.250
14	156.700	156.700	161.300
15	156.750	156.750	161.350
16	156.800	156.800	161.400
17	156.850	156.850	161.450
18	156.900	156.900	161.500
19	156.950	156.950	161.550
20	157.000	157.000	161.600
21	157.050	157.050	161.650
22	157.100	157.100	161.700
23	157.150	157.150	161.750
24	157.200	157.200	161.800
25	157.250	157.250	161.850
26	157.300	157.300	161.900
27	157.350	157.350	161.950
28	157.400	157.400	162.000
29	157.450	157.450	162.050
30	157.500	157.500	162.100
31	157.550	157.550	162.150
32	157.600	157.600	162.200
33	157.650	157.650	162.250
34	157.700	157.700	162.300
35	157.750	157.750	162.350
36	157.800	157.800	162.400
37	157.850	157.850	162.450
38	157.900	157.900	162.500
39	157.950	157.950	162.550
40	158.000	158.000	162.600
41	158.050	158.050	162.650
42	158.100	158.100	162.700
43	158.150	158.150	162.750
44	158.200	158.200	162.800
45	158.250	158.250	162.850
46	158.300	158.300	162.900
47	158.350	158.350	162.950
48	158.400	158.400	163.000
49	158.450	158.450	163.050
50	158.500	158.500	163.100

EXPANSION CHANNEL SELECTION CHART

CHANNEL NO.	TRANSMITTER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (DUPLEX)
51	158.550	158.550	163.150
52	158.600	158.600	163.200
53	158.650	158.650	163.250
54	158.700	158.700	163.300
55	158.750	158.750	163.350
56	158.800	158.800	163.400
57	158.850	158.850	163.450
58	158.900	158.900	163.500
59	158.950	158.950	163.550
60	156.025	156.025	160.625
61	156.075	156.075	160.675
62	156.125	156.125	160.725
63	156.175	156.175	160.775
64	156.225	156.225	160.825
65	156.275	156.275	160.875
66	156.325	156.325	160.925
67	156.375	156.375	160.975
68	156.425	156.425	161.025
69	156.475	156.475	161.075
70	156.525	156.525	161.125
71	156.575	156.575	161.175
72	156.625	156.625	161.225
73	156.675	156.675	161.275
74	156.725	156.725	161.325
75	GUARD	GUARD	GUARD
76	GUARD	GUARD	GUARD
77	156.875	156.875	161.475
78	156.925	156.925	161.525
79	156.975	156.975	161.575
80	157.025	157.025	161.625
81	157.075	157.075	161.675
82	157.125	157.125	161.725
83	157.175	157.175	161.775
84	157.225	157.225	161.825
85	157.275	157.275	161.875
86	157.325	157.325	161.925
87	157.375	157.375	161.975
88	157.425	157.425	162.025
90	157.525	157.525	162.125
91	157.575	157.575	162.175
92	157.625	157.625	162.225
93	157.675	157.675	162.275
94	157.725	157.725	162.325
95	157.775	157.775	162.375
96	157.825	157.825	162.425
97	157.875	157.875	162.475
98	157.925	157.925	162.525
99	157.975	157.975	162.575
100	158.025	158.025	162.625
101	158.075	158.075	162.675
102	158.125	158.125	162.725
103	158.175	158.175	162.775
104	158.225	158.225	162.825
105	158.275	158.275	162.875

EXPANSION CHANNEL SELECTION CHART

CHANNEL NO.	TRANSMITTER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (SIMPLEX)	RECEIVER FREQUENCY (DUPLEX)
106	158.325	158.325	162.925
107	158.375	158.375	162.975
108	158.425	158.425	163.025
109	158.475	158.475	163.075
110	158.525	158.525	163.125
111	158.575	158.575	163.175
112	158.625	158.625	163.225
113	158.675	158.675	163.275
114	158.725	158.725	163.325
115	158.775	158.775	163.375
116	158.825	158.825	163.425
117	158.875	158.875	163.475
118	158.925	158.925	163.525
119	158.975	158.975	163.575
120	155.975	155.975	160.575
121	155.950	155.950	160.550
122	155.925	155.925	160.525
123	155.900	155.900	160.500
124	155.875	155.875	160.475
125	155.850	155.850	160.450
126	155.825	155.825	160.425
127	155.800	155.800	160.400
128	155.775	155.775	160.375
129	155.750	155.750	160.350
130	155.725	155.725	160.325
131	155.700	155.700	160.300
132	155.675	155.675	160.275
133	155.650	155.650	160.250
134	155.625	155.625	160.225
135	155.600	155.600	160.200
136	155.575	155.575	160.175
137	155.550	155.550	160.150
138	155.525	155.525	160.125
139	155.500	155.500	160.100
140	155.475	155.475	160.075
141	155.450	155.450	160.050
142	155.425	155.425	160.025
143	155.400	155.400	160.000
144	155.375	155.375	159.975
145	155.350	155.350	159.950
146	155.325	155.325	159.925
147	155.300	155.300	159.900
148	155.275	155.275	159.875
149	155.250	155.250	159.850
150	155.225	155.225	159.825
151	155.200	155.200	159.800
152	155.175	155.175	159.775
153	155.150	155.150	159.750
154	155.125	155.125	159.725
155	155.100	155.100	159.700
156	155.075	155.075	159.675
157	155.050	155.050	159.650
158	155.025	155.025	159.625
159	155.000	155.000	159.600



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